2009 Touring

SERVICE MANUAL

Part Number 99483-09

Chapter 1 Maintenance
Chapter 2 Chassis
Chapter 3 Engine
Chapter 4 Fuel System
Chapter 5 Drive
Chapter 6 Transmission
Chapter 7 Electrical

ELECTRICAL DIAGNOSTICS

Part Number 99497-09

Chapter 1 Starting / Charging
Chapter 2 Instruments
Chapter 3 TSM/HFSM
Chapter 4 Engine Management
Chapter 5 Audio System
Chapter 6 ABS



2009 Touring Models Service Manual

99483-09

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IMPORTANT NOTICE

Harley-Davidson motorcycles conform to all applicable U.S.A. Federal Motor Vehicle Safety Standards and U.S.A. Environmental Protection Agency regulations effective on the date of manufacture.

To maintain the safety, dependability, and emission and noise control performance, it is essential that the procedures, specifications and service instructions in this manual are followed.

Any substitution, alteration or adjustment of emission system and noise control components outside of factory specifications may be prohibited by law.

Harley-Davidson Motor Company

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2009 Touring Models Service Manual (99483-09)

Please clip out and mail to:
Service Communications Department
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P.O. Box 653
Milwaukee, WI USA 53201

NOTES

ABOUT THIS MANUAL

GENERAL

This Service Manual has been prepared with two purposes in mind. First, it will acquaint the user with the construction of the Harley-Davidson product and assist in the performance of basic maintenance and repair. Secondly, it will introduce to the professional Harley-Davidson Technician the latest field-tested and factory-approved major repair methods. We sincerely believe that this Service Manual will make your association with Harley-Davidson products more pleasant and profitable.

HOW TO USE YOUR SERVICE MANUAL

Refer to the table below for the content layout of this manual.

NO.	CHAPTER
1	Maintenance
2	Chassis
3	Engine
4	Fuel System
5	Drive
6	Transmission
7	Electrical
A	Appendix A Connector Repair
B	Appendix B Wiring
C	Appendix C ABS
D	Appendix D Conversions
E	Appendix E Glossary

Use the TABLE OF CONTENTS (which follows this FOREWORD) and the INDEX (at the back of this manual) to quickly locate subjects. Sections and topics in this manual are sequentially numbered for easy navigation.

For example, a cross-reference shown as **2.1 SPECIFICATIONS** refers to chapter 2 CHASSIS, heading 2.1 SPECIFICATIONS.

For quick and easy reference, all pages contain a section number followed by a page number. For example, **page 3-5** refers to page 5 in section 3.

A number of acronyms and abbreviations are used in this document. See the E.1 GLOSSARY for a list of acronyms, abbreviations and definitions.

PREPARATION FOR SERVICE

⚠WARNING

Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

Good preparation is very important for efficient service work. A clean work area at the start of each job will allow you to perform the repair as easily and quickly as possible, and will reduce the incidence of misplaced tools and parts. A motorcycle that is excessively dirty should be cleaned before work starts. Cleaning will occasionally uncover sources of trouble. Tools, instruments and any parts needed for the job should be gathered before work is started. Interrupting a job to locate tools or parts is a distraction and causes needless delay.

NOTES

- *To avoid unnecessary disassembly, carefully read all relative service information before repair work is started.*
- *In figure legends, the number which follows the name of a part indicates the quantity necessary for one complete assembly.*
- *When servicing a vehicle equipped with the Harley-Davidson Smart Security System (H-DSSS), you must first disarm the security system. Either keep the fob in close proximity to the vehicle, or use Digital Technician II to disable the security system while the vehicle is being serviced and re-enable the system after service is completed.*

SERVICE BULLETINS

In addition to the information presented in this Service Manual, Harley-Davidson Motor Company will periodically issue Service Bulletins to Harley-Davidson dealers. Service Bulletins cover interim engineering changes and supplementary information. Consult the Service Bulletins to keep your product knowledge current and complete.

USE GENUINE REPLACEMENT PARTS

⚠WARNING

Do not use aftermarket parts and custom made front forks which can adversely affect performance and handling. Removing or altering factory installed parts can adversely affect performance and could result in death or serious injury. (00001a)

To ensure satisfactory and lasting repairs, carefully follow the Service Manual instructions and use only genuine Harley-Davidson replacement parts. Behind the emblem bearing the words GENUINE HARLEY-DAVIDSON stand more than 100 years of design, research, manufacturing, testing and inspecting experience. This is your assurance that the parts you are using will fit right, operate properly and last longer.

WARNINGS AND CAUTIONS

Statements in this service manual preceded by the following words are of special significance.

⚠WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. (00119a)

⚠CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. (00139a)

CAUTION

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage. (00140a)

NOTE

Refers to important information, and is placed in italic type. It is recommended that you take special notice of these items.

Proper service and repair is important for the safe, reliable operation of all mechanical products. The service procedures recommended and described in this service manual are effective methods for performing service operations.

⚠WARNING

Always wear proper eye protection when using hammers, arbor or hydraulic presses, gear pullers, spring compressors, slide hammers and similar tools. Flying parts could result in death or serious injury. (00496b)

Some of these service operations require the use of tools specially designed for the purpose. These special tools should be used when and as recommended. It is important to note that some warnings against the use of specific service methods, which could damage the motorcycle or render it unsafe, are stated in this service manual. However, please remember that these warnings are not all-inclusive. Inadequate safety precautions could result in death or serious injury.

Since Harley-Davidson could not possibly know, evaluate or advise the service trade of all possible ways in which service might be performed, or of the possible hazardous consequences of each method, we have not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by Harley-Davidson must first thoroughly satisfy himself that neither his nor the operator's safety will be jeopardized as a result. Failure to do so could result in death or serious injury.

PRODUCT REFERENCES

⚠WARNING

Read and follow warnings and directions on all products. Failure to follow warnings and directions can result in death or serious injury. (00470b)

When reference is made in this manual to a specific brand name product, tool or instrument, an equivalent product, tool or instrument may be substituted.

Kent-Moore Products

All tools mentioned in this manual with an "HD", "J" or "B" preface must be ordered through SPX Kent-Moore. For ordering information or product returns, warranty or otherwise, visit www.spx.com.

Loctite Sealing and Threadlocking Products

Some procedures in this manual call for the use of Loctite products. If you have any questions regarding Loctite product usage or retailer/wholesaler locations, please contact Loctite Corp. at www.loctite.com.

PRODUCT REGISTERED MARKS

Alcantara S.p.A., Allen, Amp Multilock, Bluetooth, Brembo, Delphi, Deutsch, Dunlop, Dynojet, Fluke, G.E. Versilube, Gunk, Hydroseal, Hylomar, Kevlar, Lexan, Loctite, Lubriplate, Keps, K&N, Magnaflux, Marson Thread-Setter Tool Kit, MAXI fuse, Molex, MPZ, Mulitilock, Novus, Packard, Pirelli, Permatex, Philips, PJ1, Pozidriv, Robinair, S100, Sems, Snap-on, Teflon, Threadlocker, Torca, Torco, TORX, Tufoil, Tyco, Ultratorch, Velcro, X-Acto, and XM Satellite Radio are among the trademarks of their respective owners.

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All photographs, illustrations and procedures may not necessarily depict the most current model or component, but are based on the latest production information available at the time of publication.

Since product improvement is our continual goal, Harley-Davidson reserves the right to change specifications, equipment or designs at any time without notice and without incurring obligation.

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NOTES

FASTENER TORQUE VALUES 1.1

FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

FASTENER	TORQUE VALUE		NOTES
Adjuster screw jam nut	72-120 **in-lbs**	8.1-13.6 Nm	1.11 CLUTCH, Adjustment
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	1.3 MAINTENANCE SCHEDULE, General
Air cleaner cover bracket screws	40-60 **in-lbs**	4.5-6.8 Nm	1.9 AIR CLEANER AND EXHAUST SYSTEM, Installation/metric
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.3 MAINTENANCE SCHEDULE, General
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.9 AIR CLEANER AND EXHAUST SYSTEM, Installation/Use Loctite Medium Strength Threadlocker 243 (Blue)
Auxiliary lamp flange nut	15-18 ft-lbs	20.3-24.4 Nm	1.23 HEADLAMP ALIGNMENT, Auxiliary Lamp Alignment
Battery terminal bolt	60-70 **in-lbs**	6.8-7.9 Nm	1.3 MAINTENANCE SCHEDULE, General
Battery terminal bolt	60-70 **in-lbs**	6.8-7.9 Nm	1.17 BATTERY MAINTENANCE, Battery
Battery terminal bolt	60-70 **in-lbs**	6.8-7.9 Nm	1.17 BATTERY MAINTENANCE, Battery
Brake caliper (front) mounting screws	28-38 ft-lbs	37.9-51.5 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement/metric
Brake caliper (rear) to caliper bracket screws	43-48 ft-lbs	58.3-65.1 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement/metric
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	1.16 BLEEDING BRAKES, Procedure
Brake caliper pad pin	75-102 **in-lbs**	8.5.-11.5 Nm	1.3 MAINTENANCE SCHEDULE, General
Brake caliper pad pin	75-102 **in-lbs**	8.5-11.5 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement/Always use new pin
Brake caliper pad pin	75-102 **in-lbs**	8.5-11.5 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement/Always use new pin
Clutch adjuster screw locknut	72-120 **in-lbs**	8.1-13.6 Nm	1.3 MAINTENANCE SCHEDULE, General
Clutch inspection cover screws	84-108 **in-lbs**	9.5-12.2 Nm	1.3 MAINTENANCE SCHEDULE, General
Clutch inspection cover screws	84-108 **in-lbs**	9.5-12.2 Nm	1.7 PRIMARY CHAIN, Chaincase Lubricant
Clutch inspection cover screws	84-108 **in-lbs**	9.5-12.2 Nm	1.11 CLUTCH, Adjustment
Engine oil drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.3 MAINTENANCE SCHEDULE, General
Engine oil drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.6 ENGINE OIL AND FILTER, Changing Oil and Oil Filter
Engine to front engine mounting bracket	36-40 ft-lbs	49-54 Nm	1.24 ENGINE MOUNTS, Inspection
Fork bracket pinch bolt	53-57 ft-lbs	71.9-77.3 Nm	1.21 STEERING HEAD BEARINGS, Adjustment
Fork stem nut	70-80 ft-lbs	94.9-108.4 Nm	1.21 STEERING HEAD BEARINGS, Adjustment/Anti-seize
Fork stem nut	70-80 ft-lbs	94.9-108.4 Nm	1.21 STEERING HEAD BEARINGS, Adjustment/Anti-seize
Front engine mount end cap fastener	42-48 ft-lbs	56.9-65.0 Nm	1.24 ENGINE MOUNTS, Inspection
Front master cylinder reservoir cover screws	7-10 **in-lbs**	0.8-1.1 Nm	1.14 BRAKES, Fluid Inspection
Front master cylinder reservoir cover screws	7-10 **in-lbs**	0.8-1.1 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement

FASTENER	TORQUE VALUE		NOTES
Front master cylinder reservoir cover screws	7-10 **in-lbs**	0.8-1.1 Nm	1.16 BLEEDING BRAKES, Procedure
Front stabilizer link eyelet	18-22 ft-lbs	24.4-29.9 Nm	1.24 ENGINE MOUNTS, Inspection
Front stabilizer link eyelet	18-22 ft-lbs	24.4-29.9 Nm	1.24 ENGINE MOUNTS, Inspection
Handlebar switch housing screw	35-45 **in-lbs**	4.0-5.1 Nm	1.3 MAINTENANCE SCHEDULE, General
Master cylinder reservoir cover	7-10 **in-lbs**	0.8-1.1 Nm	1.3 MAINTENANCE SCHEDULE, General
Master cylinder reservoir cover	12-15 **in-lbs**	1.4-1.7 Nm	1.3 MAINTENANCE SCHEDULE, General
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.3 MAINTENANCE SCHEDULE, General
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.7 PRIMARY CHAIN, Chaincase Lubricant
Rear axle cone nut	15-20 ft-lbs	20-27 Nm	1.13 REAR BELT DEFLECTION, Setting Belt Deflection/For belt adjustment only
Rear axle cone nut	95-105 ft-lbs	128.8-142.4 Nm	1.13 REAR BELT DEFLECTION, Setting Belt Deflection
Rear frame-to-main frame fastener	40-50 ft-lbs	54.2-67.8 Nm	1.24 ENGINE MOUNTS, Inspection
Rear master cylinder reservoir cover screws	12-15 **in-lbs**	1.4-1.7 Nm	1.14 BRAKES, Fluid Inspection
Rear master cylinder reservoir cover screws	12-15 **in-lbs**	1.4-1.7 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement
Rear master cylinder reservoir cover screws	12-15 **in-lbs**	1.4-1.7 Nm	1.16 BLEEDING BRAKES, Procedure
Rear muffler fastener	96-144 **in-lbs**	10.9-16.3 Nm	1.13 REAR BELT DEFLECTION, Setting Belt Deflection
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.3 MAINTENANCE SCHEDULE, General
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.20 SPARK PLUGS, Inspection
Spoke nipple	55 **in-lbs**	6.2 Nm	1.3 MAINTENANCE SCHEDULE, General
Spoke nipple	55 **in-lbs**	6.2 Nm	1.10 TIRES AND WHEELS, Wheel Spokes
Top caddy mounting screw	72-96 **in-lbs**	8.1-10.9 Nm	1.3 MAINTENANCE SCHEDULE, General
Top caddy mounting screw	72-96 **in-lbs**	8.1-10.9 Nm	1.17 BATTERY MAINTENANCE, Battery
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.3 MAINTENANCE SCHEDULE, General
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.8 TRANSMISSION LUBRICANT, Transmission Lubrication
Transmission filler/check plug	25-75 **in-lbs**	2.8-8.5 Nm	1.3 MAINTENANCE SCHEDULE, General
Transmission filler/check plug	25-75 **in-lbs**	2.8-8.5 Nm	1.8 TRANSMISSION LUBRICANT, Transmission Lubrication
Transmission filler/check plug	25-75 **in-lbs**	2.8-8.5 Nm	1.8 TRANSMISSION LUBRICANT, Transmission Lubrication
Turn signal lamp to mounting bracket screws	36-60 **in-lbs**	4.1-6.8 Nm	1.23 HEADLAMP ALIGNMENT, Auxiliary Lamp Alignment

GENERAL 1.2

SERVICING A NEW MOTORCYCLE

⚠WARNING

Perform the service and maintenance operations as indicated in the regular service interval table. Lack of regular maintenance at the recommended intervals can affect the safe operation of your motorcycle, which could result in death or serious injury. (00010a)

Service operations to be performed before customer delivery are specified in the applicable model year predelivery and set-up instructions.

The performance of new motorcycle initial service is required to keep warranty in force and to verify proper emissions systems operation. See 1.3 MAINTENANCE SCHEDULE.

SAFE OPERATING MAINTENANCE

NOTES

- *Do not attempt to retighten engine head bolts. Retightening can cause engine damage.*
- *During the initial break-in period, use only Harley-Davidson 20W50 engine oil. Failure to use the recommended oil will result in improper break-in of the engine cylinders and piston rings.*

A careful check of certain equipment is necessary after periods of storage, and frequently between regular service intervals, to determine if additional maintenance is required.

Check:

1. Tires for abrasions, cuts and correct pressure.
2. Secondary drive belt for proper tension and condition.
3. Brakes, steering and throttle for responsiveness.
4. Brake fluid level and condition. Hydraulic lines and fittings for leaks. Also, check brake pads and rotors for wear.
5. Cables for fraying, crimping and free operation.
6. Engine oil and transmission fluid levels.
7. Headlamp, auxiliary lamp, tail lamp, brake lamp, horn and turn signal operation.

SHOP PRACTICES

Repair Notes

General maintenance practices are given in this section.

NOTES

- *Repair = Disassembly/Assembly.*
- *Replacement = Substitute a **new** part for existing component.*

All special tools and torque values are noted at the point of use.

All required parts or materials can be found in the appropriate PARTS CATALOG.

Safety

Safety is always the most important consideration when performing any job. Be sure you have a complete understanding of the task to be performed. Use common sense. Use the proper tools. Protect yourself and bystanders with approved eye protection. Don't just do the job - do the job safely.

Removing Parts

Always consider the weight of a part when lifting. Use a hoist whenever necessary. Do not lift heavy parts by hand. A hoist and adjustable lifting beam or sling are needed to remove some parts. The lengths of chains or cables from the hoist to the part should be equal and parallel and should be positioned directly over the center of the part. Be sure that no obstructions will interfere with the lifting operation. Never leave a part suspended in mid-air.

⚠WARNING

Be sure to check capacity rating and condition of hoists, slings, chains and cables before use. Exceeding capacity ratings or using lifting devices that are in poor condition can lead to an accident, which could result in death or serious injury. (00466c)

Always use blocking or proper stands to support the part that has been hoisted. If a part cannot be removed, verify that all bolts and attaching hardware have been removed. Check to see if any parts are in the way of the part being removed.

When removing hoses, wiring or tubes, always tag each part to verify proper installation.

Cleaning

If you intend to reuse parts, follow good shop practice and thoroughly clean the parts before assembly. Keep all dirt out of parts; the unit will perform better and last longer. Seals, filters and covers are used in this vehicle to keep out environmental dirt and dust. These items must be kept in good condition to guarantee satisfactory operation.

When you are instructed in a step to clean fastener threads or threaded holes, proceed as follows: Clean all LOCTITE material from fastener threads and threaded holes. Use a wire brush to clean fastener threads. Use a thread chaser or other suitable tool to clean threaded holes. Use PJ-1 cleaner or equivalent to remove all traces of oil and contaminants from threads. Blow out all threaded holes with low pressure compressed air.

Clean and inspect all parts as they are removed. Be sure all holes and passages are clean and open. After cleaning, cover all parts with clean lint-free cloth, paper or other material. Be sure the part is clean when it is installed.

Always clean around lines or covers before they are removed. Plug, tape or cap holes and openings to keep out dirt, dust and debris.

Always verify cleanliness of blind holes before assembly. Tightening a screw with dirt, water or oil in the hole can cause castings to crack or break.

Disassembly and Assembly

Always assemble or disassemble one part at a time. Do not work on two assemblies simultaneously. Be sure to make all necessary adjustments. Recheck your work when finished. Be sure that everything is done.

Operate the vehicle to perform any final check or adjustments. If all is correct, the vehicle is ready to go back to the customer.

Checking Torques on Fasteners

Attempt to turn the fastener using a torque wrench set to the minimum torque specification for that fastener. If the fastener does not rotate, the fastener torque has been maintained. If the fastener rotates, remove it to determine if it is a lock-patch type.

If it has a locking agent, clean all locking material from the threaded hole. Replace the fastener with a new one or clean the original fastener threads and apply the appropriate Loctite product (see appropriate procedure). Install and tighten the fastener to specification.

If the fastener is not lock-patch type, install and tighten to specification.

Magnetic Parts Trays

Magnetic parts trays are becoming common in the service facility because they are convenient and can keep parts from becoming lost during a repair procedure.

However, hardened steel parts can become magnetized when held in magnetic parts trays. Metal fragments that would ordinarily be washed away in the oil and trapped in the oil filter or magnetic drain plug during vehicle operation could be captured by magnetized parts in the engine, potentially causing accelerated engine wear and damage.

Parts that will be returned to service inside the vehicle's powertrain such as gears, thrust washers and especially bearings should never be kept in magnetic parts trays.

REPAIR AND REPLACEMENT PROCEDURES

Hardware and Threaded Parts

Install helical thread inserts when inside threads in castings are stripped, damaged or not capable of withstanding specified torque.

Replace bolts, nuts, studs, washers, spacers and small common hardware if missing or in any way damaged. Clean up or repair minor thread damage with a suitable tap or die.

Replace all damaged or missing lubrication fittings.

Use Teflon pipe sealant or LOCTITE 565 THREAD SEALANT on pipe fitting threads.

Threadlocking Agents

Always follow specific service manual procedures when working with fasteners containing preapplied threadlocking agents when fastener replacement is recommended. When re-using fasteners containing threadlocking agents, be sure to completely remove all existing threadlocking agent from fastener threads with a wire brush or wire wheel. Also, be sure to remove residual threadlocking agent from fastener hole using an appropriate thread chasing device and compressed air when using new or existing fasteners. Always use the recommended threadlocking agent for your specific procedure.

Wiring, Hoses and Lines

Hoses, clamps, electrical wiring, electrical switches or fuel lines if they do not meet specifications.

Instruments and Gauges

Replace broken or defective instruments and gauges. Replace dials and glass that are so scratched or discolored that reading is difficult.

Bearings

Anti-friction bearings must be handled in a special way. To keep out dirt and abrasives, cover the bearings as soon as they are removed from the package.

Wash bearings in a non-flammable cleaning solution. Knock out packed lubricant inside by tapping the bearing against a wooden block. Wash bearings again. Cover bearings with clean material after setting them down to dry. Never use compressed air to dry bearings.

Coat bearings with clean oil. Wrap bearings in clean paper.

When bearings are installed against shoulders, be sure that the chamfered side of the bearing always faces the shoulder. Lubricate bearings and all metal contact surfaces before pressing into place. Only apply pressure on the part of the bearing that makes direct contact with the mating part. Install bearings with numbered side facing out.

Always use the proper tools and fixtures for removing and installing bearings.

Bearings do not usually need to be removed. Only remove bearings if necessary.

Bushings

Do not remove a bushing unless damaged, excessively worn or loose in its bore. Press out bushings that must be replaced.

When pressing or driving bushings, be sure to apply pressure in line with the bushing bore. Use a bearing/bushing driver or a bar with a smooth, flat end. Never use a hammer to drive bushings.

Inspect the bushing and the mated part for oil holes. Be sure all oil holes are properly aligned.

Gaskets

Always discard gaskets after removal. Replace with **new** gaskets. Never use the same gasket twice. Be sure that gasket holes match up with holes in the mating part. But be aware that sections of a gasket may be used to seal passages.

If a gasket must be made, be sure to cut holes that match up with the mating part. Serious damage can occur if any flange holes are blocked by the gasket. Use material that is the right type and thickness.

Lip Type Seals

Lip seals are used to seal oil or grease and are usually installed with the sealing lip facing the contained lubricant. Seal orientation, however, may vary under different applications.

Seals should not be removed unless necessary. Only remove seals if required to gain access to other parts or if seal damage or wear dictates replacement.

Leaking oil or grease usually means that a seal is damaged. Replace leaking seals to prevent overheated bearings.

Always discard seals after removal. Do not use the same seal twice.

O-Rings (Preformed Packings)

Always discard o-rings after removal. Replace with **new** o-rings. To prevent leaks, lubricate the o-rings before installation. Apply the same type of lubricant as that being sealed. Be sure that all gasket, o-ring and seal mating surfaces are thoroughly clean before installation.

Gears

Always check gears for damaged or worn teeth.

Remove burrs and rough spots with a honing stone or crocus cloth before installation.

Lubricate mating surfaces before pressing gears on shafts.

Shafts

If a shaft does not come out easily, check that all nuts, bolts or retaining rings have been removed. Check to see if other parts are in the way before using force.

Shafts fitted to tapered splines should be very tight. If shafts are not tight, disassemble and inspect tapered splines. Discard parts that are worn. Be sure tapered splines are clean, dry and free of burrs before putting them in place. Press mating parts together tightly.

Clean all rust from the machined surfaces of new parts.

Part Replacement

Always replace worn or damaged parts with **new** parts.

Exhaust System Leakage

In the event of an exhaust system leak at a muffler or header pipe connection location, disassemble and clean all mating surfaces. Replace any damaged components. If leak still exists, disassemble and repair the leak by applying a bead of Harley-Davidson High-Performance Sealant (Part No. 99650-02) (or an equivalent 02 Sensor/Catalyst-safe alternative). Reassemble components, wipe off any excess sealant and allow adequate curing time following sealant product instructions before operating vehicle.

CLEANING

Part Protection

Before cleaning, protect rubber parts (such as hoses, boots and electrical insulation) from cleaning solutions. Use a grease-proof barrier material. Remove the rubber part if it cannot be properly protected.

Cleaning Process

Any cleaning method may be used as long as it does not result in parts damage. Thorough cleaning is necessary for proper parts inspection. Strip rusted paint areas to bare metal before priming and repainting.

Rust or Corrosion Removal

Remove rust and corrosion with a wire brush, abrasive cloth, sand blasting, vapor blasting or rust remover. Use buffing crocus cloth on highly polished parts that are rusted.

Bearings

Remove shields and seals from bearings before cleaning. Clean bearings with permanent shields and seals in solution.

⚠WARNING

Using compressed air to "spin dry" bearings can cause bearing to fly apart, which could result in death or serious injury. (00505b)

Clean open bearings by soaking them in a petroleum cleaning solution. Never use a solution that contains chlorine.

Let bearings stand and dry. Do not dry with compressed air. Do not spin bearings while they are drying.

TOOL SAFETY

Air Tools

- Always use approved eye protection equipment when performing any task using air-operated tools.
- On all power tools, use only recommended accessories with proper capacity ratings.
- Do not exceed air pressure ratings of any power tools.
- Bits should be placed against work surface before air hammers are operated.
- Disconnect the air supply line to an air hammer before attaching a bit.
- Never point an air tool at yourself or another person.
- Protect bystanders with approved eye protection.

Wrenches

- Never use an extension on a wrench handle.
- If possible, always pull on a wrench handle and adjust your stance to prevent a fall if something lets go.
- Never cock a wrench.
- Never use a hammer on any wrench other than a STRIKING FACE wrench.
- Discard any wrench with broken or battered points.
- Never use a pipe wrench to bend, raise or lift a pipe.

Pliers/Cutters/Pry bars

- Plastic- or vinyl-covered pliers handles are not intended to act as insulation. Do not use on live electrical circuits.
- Do not use pliers or cutters for cutting hardened wire unless they were designed for that purpose.
- Always cut at right angles.
- Do not use any pry bar as a chisel, punch or hammer.

Hammers

- Never strike a hammer against a hardened object, such as another hammer.
- Always grasp a hammer handle firmly, close to the end.
- Strike the object with the full face of the hammer.
- Never work with a hammer which has a loose head.
- Discard hammer if face is chipped or mushroomed.
- Wear approved eye protection when using striking tools.
- Protect bystanders with approved eye protection.

Punches/Chisels

- Never use a punch or chisel with a chipped or mushroomed end; dress mushroomed chisels and punches with a file.
- Hold a chisel or a punch with a tool holder if possible.
- When using a chisel on a small piece, clamp the piece firmly in a vise and chip toward the stationary jaw.
- Wear approved eye protection when using these tools.
- Protect bystanders with approved eye protection.

Screwdrivers

- Do not use a screwdriver for prying, punching, chiseling, scoring or scraping.
- Use the right type of screwdriver for the job; match the tip to the fastener.
- Do not interchange POZIDRIV, PHILLIPS or REED AND PRINCE screwdrivers.
- Screwdriver handles are not intended to act as insulation. Do not use on live electrical circuits.
- Do not use a screwdriver with rounded edges because it will slip. Redress with a file.

Ratchets and Handles

- Periodically clean and lubricate ratchet mechanisms with a light grade oil. Do not replace parts individually; ratchets should be rebuilt with the entire contents of service kit.
- Never hammer or put a pipe extension on a ratchet or handle for added leverage.
- Always support the ratchet head when using socket extensions, but do not put your hand on the head or you may interfere with the action of its reversing mechanism.
- When breaking loose a fastener, apply a small amount of pressure as a test to be sure the ratchet's gear wheel is engaged with the pawl.

Sockets

- Never use hand sockets on power or impact wrenches.
- Select the right size socket for the job.
- Never cock any wrench or socket.
- Select only impact sockets for use with air or electric impact wrenches.
- Replace sockets showing cracks or wear.
- Keep sockets clean.
- Always use approved eye protection when using power or impact sockets.

Storage Units

- Do not open more than one loaded drawer at a time. Close each drawer before opening up another.
- Close lids and lock drawers and doors before moving storage units.
- Do not pull on a tool cabinet; push it in front of you.
- Set the brakes on the locking casters after the cabinet has been rolled to your workspace.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

MAINTENANCE SCHEDULE 1.3

GENERAL

The table below lists the periodic maintenance requirements for Touring model motorcycles. If you are familiar with the procedures, just refer to the table for the recommended service interval. If necessary, see the quick reference table (Table 1-2.) for the required specifications.

If more detailed information is needed, turn to the sections which follow for step-by-step instructions.

Also, throughout this manual, you will be instructed to use various lubricants, greases and sealants. Refer to Table 1-3. for the correct part numbers of these items.

Table 1-1. Regular Service Intervals: 2009 Touring Models

ITEM SERVICED	PROCEDURE	1000 MI. 1600 KM	5000 MI. 8000 KM	10,000 MI. 16,000 KM	15,000 MI. 24,000 KM	20,000 MI. 32,000 KM	25,000 MI. 40,000 KM	NOTES
Engine oil and filter	Replace	X	X	X	X	X	X	
Oil lines and brake system	Inspect for leaks	X	X	X	X	X	X	1
Air cleaner	Inspect, service as required	X	X	X	X	X	X	
Tires	Check pressure, inspect tread	X	X			X		
Wheel spokes	Check tightness	X	X			X		1, 6
Primary chaincase lubricant	Replace	X		X		X		
Transmission lubricant	Replace	X				X		
Clutch	Check adjustment	X	X	X	X	X	X	1
Drive belt and compensator sprocket	Inspect, adjust belt	X	X	X	X	X	X	1
Compensator sprocket isolators	Inspect for wear							5
Brake and clutch controls	Check, adjust and lubricate	X	X	X	X	X	X	1
Jiffy stand	Inspect and lubricate	X	X	X	X	X	X	1
Fuel lines and fittings	Inspect for leaks	X	X	X	X	X	X	1
Fuel tank filter	Replace						X	1
Brake fluid	Check levels and condition	X	X	X	X	X	X	4
Brake pads and discs	Inspect for wear	X	X	X	X	X	X	
Spark plugs	Inspect	X	X	X	X		X	
	Replace					X		
Electrical equipment and switches	Check operation	X	X	X	X	X	X	
Front fork oil	Replace							1, 2
Steering head bearings	Lubricate	X		X		X		2
	Adjust						X	1
Air suspension	Check pressure, operation and leakage	X	X	X	X	X	X	1
Windshield bushings (if applicable)	Inspect			X		X		1
Fuel door, Tour-Pak, saddlebags	Lubricate hinges and latches	X	X	X	X	X	X	
Critical fasteners	Check tightness	X		X		X		1
Battery	Check battery and clean connections							3
Exhaust system	Inspect for leaks, cracks, and loose or missing fasteners or heat shields	X	X	X	X	X	X	3
Road test	Verify component and system functions	X	X	X	X	X	X	
NOTES:	1. Should be performed by an authorized Harley-Davidson dealer, unless you have the proper tools, service data and are mechanically qualified. 2. Disassemble, lubricate and inspect every 50,000 miles (80,000 kilometers). 3. Perform annually. 4. Change D.O.T. 4 and flush brake system every two years. 5. Perform at each rear tire change. 6. Not all vehicles are equipped with spoke wheels. Consult appropriate topic in service manual.							

DIGITAL TECHNICIAN II HARLEY-DAVIDSON®

Table 1-2. Quick Reference Maintenance Chart: 2009 Touring Models

ITEM SERVICED	SPECIFICATION	DATA
Engine oil and filter	Drain plug torque	14-21 ft-lbs (19.0-28.5 Nm)
	Oil capacity	4 qt. (3.8 L)
	Filter	Hand tighten 1/2-3/4 turn after gasket contact
	Chrome filter part number	63798-99A
	Black filter part number	63731-99A
Primary chain lubricant	Lubricant type and capacity	FORMULA+ TRANSMISSION AND PRIMARY CHAIN LUBRICATION (Part No. 99851-05) Wet: 38 oz. (1124 ml) Dry: 45 oz. (1331 ml)
	Primary chaincase drain plug torque	14-21 ft-lbs (19.0-28.5 Nm)
Clutch adjustment	Adjuster screw free play	1/2-1 turn
	Adjuster screw locknut torque	72-120 **in-lbs** (8.1-13.6 Nm)
	Free play at hand lever	1/16-1/8 in. (1.6-3.2 mm)
	Clutch inspection cover torque	84-108 **in-lbs** (9.5-12.2 Nm)
Transmission lubricant	Lubricant level	Dipstick at FULL with motorcycle on jiffy stand and filler plug resting on threads.
	Lubricant type and capacity	FORMULA+ TRANSMISSION AND PRIMARY CHAIN LUBRICATION (Part No. 99851-05) 32 oz (0.95 liters)
	Transmission drain plug torque	14-21 ft-lbs (19.0-28.5 Nm)
	Transmission filler plug/dipstick torque	25-75 **in-lbs** (2.8-8.5 Nm)
Tire pressure and wear	Pressure: solo rider or with passenger	Front: 36 psi (248 kPA) Rear: 40 psi (276 kPA)
	Wear	Replace if less than1/32 in. (0.8 mm) of tread pattern
Wheel spokes	Spoke nipple torque	55 **in-lbs** (6.2 Nm) minimum
Brake fluid level	D.O.T. 4 hydraulic brake fluid part number	99953-99A (12 oz.)
	Fluid level (from top of master cylinder reservoir)	Front: 0.20 in. (5.0 mm) Rear: 0.26 in. (6.5 mm)
	Master cylinder reservoir cover screw torque	Front: 7-10 **in-lbs** (0.8-1.1 Nm) Rear: 12-15 **in-lbs** (1.4-1.7 Nm)
Brake pads and discs	Minimum brake pad thickness	0.016 in. (0.4 mm)
	Brake caliper pad pin torque	75-102 **in-lbs** (8.5.-11.5 Nm)
	Minimum brake disc thickness	Front: 0.18 in. (4.5 mm) Rear: 0.25 in. (6.3 mm)
	Maximum brake disc lateral runout (warpage)	0.008 in. (0.2 mm)
Drive belt deflection	Upward force applied at midpoint of bottom belt strand	10 lb. (4.5 kg)
	FLHR/C, FLHT/C/U, FLTR	3/8-7/16 in. (9.5-11.1 mm)
	FLHX	1/4-5/16 in. (6.4-7.9 mm)
Air cleaner	Air cleaner cover bracket screw torque	40-60 **in-lbs** (4.5-6.8 Nm)
	Air cleaner cover screw torque	36-60 **in-lbs** (4.1-6.8 Nm)
	Air cleaner cover screw Threadlocker	LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (BLUE) Part No. 99642-97 (6 ml)
Clutch cable	Lubricant part number	LUBIT-8 SUPER OIL, Part No. 94968-85TV (1/4 fl. oz.)
	Handlebar switch housing screw torque	35-45 **in-lbs** (4.0-5.1 Nm)

Table 1-2. Quick Reference Maintenance Chart: 2009 Touring Models

ITEM SERVICED	SPECIFICATION	DATA
Spark plugs	Type	HD-6R12
	Gap	0.038-0.043 in. (0.97-1.09 mm)
	Torque	12-18 ft-lbs (16.3-24.4 Nm)
Front fork oil	Amount	See 2.19 FRONT FORK.
	Type and part number	HYDRAULIC FORK OIL (TYPE E) Part No. 99884-80 (16 oz.)
Battery	Terminal bolt torque	60-70 **in-lbs** (6.8-7.9 Nm)
	Top caddy screw torque	72-96 **in-lbs** (8.1-10.9 Nm)

Table 1-3. Lubricants, Greases, Sealants

ITEM	PART NUMBER	PACKAGE
Anti-Seize Lubricant	98960-97	1 oz squeeze tube
CCI #20 Brake Grease	42830-05 (included in master cylinder rebuild kit)	squeeze packet
D.O.T. 4 Brake Fluid	99953-99A	12 oz. bottle
Electrical Contact Lubricant	99861-02	1 oz squeeze tube
Genuine Harley-Davidson Formula+ Transmission and Primary Chaincase Lubricant	99851-05	1 qt bottle
G40M Brake Grease	42820-04	squeeze packet
Gray High Performance Sealant	99650-02	1.9 oz squeeze tube
HYLOMAR Gasket and Thread Sealant	99653-85	3.5 oz tube
Loctite Pipe Sealant With Teflon 565	99818-97	6 ml squeeze tube
Loctite Prism Primer (770)		
Loctite Prism Superbonder (411)		
Loctite Superbonder 420 Adhesive		
Loctite Threadlocker 243 (blue)	99642-97	6 ml squeeze tube
Loctite Threadlocker 262 (red)	94759-99	6 ml squeeze tube
Loctite Threadlocker 272	98618-03	10 ml bottle
Special Purpose Grease	99857-97	14 oz. cartridge
Super Oil	94968-85TV	1/4 fl. oz
Type "E" Hydraulic Fork Oil	99884-80	16 oz bottle

DIGITAL TECHNICIAN HARLEY-DAVIDSON

FUEL AND OIL 1.4

FUEL

Refer to Table 1-4. Always use a good quality unleaded gasoline. Octane ratings are usually found on the pump.

⚠WARNING

Avoid spills. Slowly remove filler cap. Do not fill above bottom of filler neck insert, leaving air space for fuel expansion. Secure filler cap after refueling. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00028a)

⚠WARNING

Use care when refueling. Pressurized air in fuel tank can force gasoline to escape through filler tube. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00029a)

Modern service station pumps dispense a high flow of gasoline into a motorcycle fuel tank making air entrapment and pressurization a possibility.

Table 1-4. Octane Ratings

SPECIFICATION	RATING
Pump Octane (R+M)/2	91 (95 RON)

GASOLINE BLENDS

Your motorcycle was designed to get the best performance and efficiency using unleaded gasoline. Most gasoline is blended with alcohol and/or ether to create oxygenated blends. The type and amount of alcohol or ether added to the fuel is important.

CAUTION

Do not use gasoline that contains methanol. Doing so can result in fuel system component failure, engine damage and/or equipment malfunction. (00148a)

- Gasoline containing METHYL TERTIARY BUTYL ETHER (MTBE): Gasoline/MTBE blends are a mixture of gasoline and as much as 15% MTBE. Gasoline/MTBE blends can be used in your motorcycle.
- ETHANOL is a mixture of 10% ethanol (Grain alcohol) and 90% unleaded gasoline. Gasoline/ethanol blends can be used in your motorcycle if the ethanol content does **not** exceed 10%.
- REFORMULATED OR OXYGENATED GASOLINES (RFG): Reformulated gasoline is a term used to describe gasoline blends that are specifically designed to burn cleaner than other types of gasoline, leaving fewer tailpipe emissions. They are also formulated to evaporate less when you are filling your tank. Reformulated gasolines use additives to oxygenate the gas. Your motorcycle will run normally using this type of gas and Harley-Davidson recommends you use it when possible, as an aid to cleaner air in our environment.
- Do not use race gas or octane boosters. Use of these fuels will damage the fuel system.

Some gasoline blends might adversely affect the starting, driveability or fuel efficiency of the motorcycle. If any of these problems are experienced, try a different brand of gasoline or gasoline with a higher octane blend.

ENGINE LUBRICATION

CAUTION

Do not switch lubricant brands indiscriminately because some lubricants interact chemically when mixed. Use of inferior lubricants can damage the engine. (00184a)

Engine oil is a major factor in the performance and service life of the engine. Always use the proper grade of oil for the lowest temperature expected before the next scheduled oil change. Refer to Table 1-5. Your authorized dealer has the proper oil to suit your requirements.

If it is necessary to add oil and Harley-Davidson oil is not available, use an oil certified for diesel engines. Acceptable diesel engine oil designations include: CF-4, CG-4, CH-4 and CI-4.

The preferred viscosities for the diesel engine oils in descending order are: 20W50, 15W40 and 10W40.

At the first opportunity, see an authorized dealer to change back to 100 percent Harley-Davidson oil.

Table 1-5. Recommended Engine Oils

H-D TYPE	VISCOSITY	H-D RATING	LOWEST AMBIENT TEMPERATURE	COLD WEATHER STARTS BELOW 50° F (10° C)
H-D Multi-grade	SAE 10W40	HD 360	Below 40° F (4° C)	Excellent
H-D Multi-grade	SAE 20W50	HD 360	Above 40° F (4° C)	Good
H-D Regular Heavy	SAE 50	HD 360	Above 60° F (16° C)	Poor
H-D Extra Heavy	SAE 60	HD 360	Above 80° F (27° C)	Poor

WINTER LUBRICATION

In colder climates, the engine oil should be changed often. If motorcycle is used frequently for short trips, less than 15 miles (24 kilometers), in ambient temperatures below 60° F (16° C), oil change intervals should be reduced to 1500 miles (2400 kilometers). Motorcycles used only for short runs must have a thorough tank flush-out before **new** oil is put in. The tank flush-out should be performed by an authorized dealer or qualified technician.

NOTE

The further below freezing the temperature drops, the shorter the oil change interval should be.

Water vapor is a normal by-product of combustion in any engine. During cold weather operation, some of the water vapor condenses to liquid form on the cool metal surfaces inside the engine. In freezing weather this water will become slush or ice and, if allowed to accumulate too long, may block the oil lines and cause damage to the engine.

If the engine is run frequently and allowed to thoroughly warm up, most of this water will become vapor again and will be blown out through the crankcase breather.

If the engine is not run frequently and allowed to thoroughly warm up, this water will accumulate, mix with the engine oil and form a sludge that is harmful to the engine.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

BULB REQUIREMENTS 1.5

GENERAL

Use the table to identify the bulb location and part number. Refer to Table 1-6.

NOTE

The speedometer, tachometer, odometer and indicator lamps are illuminated with LEDs. LEDs are non-repairable. The entire assembly must be replaced if an LED fails.

Table 1-6. Bulb Chart: 2009 Touring Models

LAMP	DESCRIPTION (ALL LAMPS 12 VOLT)	BULBS REQUIRED	CURRENT DRAW AMPERAGE	HARLEY-DAVIDSON PART NUMBER
Headlamp	FLHT/C/U, FLHR/C, FLHX	1	4.58/5.0	68329-03
	FLTR	2	4.58/5.0	68329-03
	Position lamp, international	1	0.32	53438-92
	Position lamp, FLTR Japan	1	0.32	53436-97
Tail and stop lamp	Tail/stop lamp	1	0.59/2.10	68167-04
Turn signal lamp	Front/running	2	2.25/0.59	68168-89A
	Front international	2	1.75	68572-64B
	Front, FLHX (HDI), FLTR (Japan)	2	1.75	68163-84
	Rear	2	2.25	68572-64B
	Rear, FLTR/FLHX international	2	1.75	68163-84
	Rear, other international	2	1.75	68163-84
Additional lighting	Tour-Pak side lamps FLHTCU*	N/A	0.14 0.14	53788-06 (right side) 53789-06 (left side)
	Tour-Pak tail/stop lamps	2	0.59/2.10	68165-64
	Fender tip lamps, front	1	0.30	68193-95
	Fender tip lamps, rear*	N/A	N/A	69375-06 (FLHX) 59672-09 (all but FLHX)
	License plate lamp international	1	0.37	53436-97
	License plate lamp FLTR/FLHX domestic	2	0.35	52441-95
	Auxiliary lamps	2	2.1	68453-05
	Auxiliary lamps international	2	2.7	68851-98
Instrument panel lamps FLHT/C/U FLHR/C FLTR FLHX	High beam indicator	Instrument panel is illuminated with LEDs. Replace entire assembly upon failure.		
	Oil pressure indicator			
	Neutral indicator			
	Turn signal indicator			
Gauge lamps FLHR/C	Speedometer	N/A	N/A	N/A
	Odometer	N/A	N/A	N/A
	Fuel gauge*	Illuminated with LEDs. Replace assembly upon failure.		
	Engine	N/A	N/A	N/A

DIGITAL TECHNICIAN HARLEY-DAVIDSON®

Table 1-6. Bulb Chart: 2009 Touring Models

LAMP	DESCRIPTION (ALL LAMPS 12 VOLT)	BULBS REQUIRED	CURRENT DRAW AMPERAGE	HARLEY-DAVIDSON PART NUMBER
Gauge lamps FLHT/C/U FLTR FLHX	Speedometer	N/A	N/A	N/A
	Tachometer	N/A	N/A	N/A
	Voltmeter	1	0.24	67445-00
	Oil pressure indicator FLHT/C/U	1	0.24	67445-00
	Air temperature gauge FLHT/C/U	1	0.24	67445-00
	Fuel gauge	1	0.24	67445-00
Items with *	Illuminated with LEDs. Replace entire assembly upon failure.			

DIGITAL TECHNICIAN® II
HARLEY-DAVIDSON®

ENGINE OIL AND FILTER 1.6

CHECKING OIL LEVEL

CAUTION

Oil level cannot be accurately measured on a cold engine. For pre-ride inspection, with motorcycle leaning on jiffy stand on level ground, oil should register on dipstick between arrows when engine is cold. Do not add oil to bring the level to the FULL mark on a COLD engine. (00185a)

For dipstick location, see Figure 1-1.

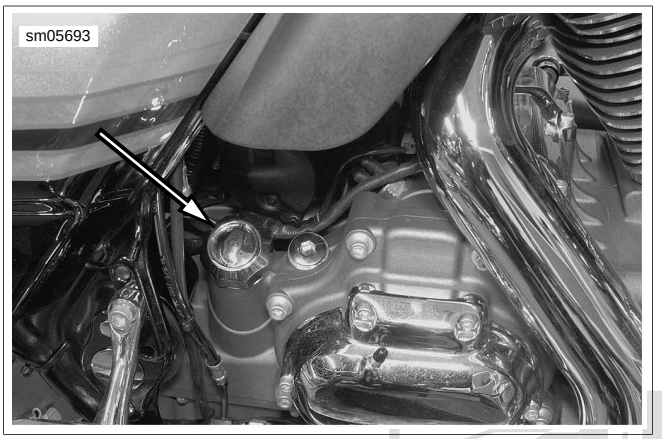


Figure 1-1. Engine Oil Filler Cap

NOTES

See Figure 1-2. The oil level marks for checking oil level with motorcycle upright or on jiffy stand are on the same side of the dipstick. Be sure to use the correct portion of dipstick when checking oil level. Oil level must not exceed the midpoint (2) when performing cold oil level check.

Oil Level Cold Check

Perform engine oil level **COLD CHECK** as follows:

1. For pre-ride inspection, place vehicle on level ground and rest the vehicle on its jiffy stand (unless sidecar is attached).
2. Remove filler plug/dipstick and wipe off the dipstick. Insert the dipstick and tighten into the fill spout.

NOTE

The oil level marks for checking with motorcycle upright or on jiffy stand are on the same side of the dipstick. Be sure to use the correct portion of dipstick when checking oil level.

3. See Figure 1-2. Remove the dipstick and verify the level of the oil. The correct oil level should register midway (2) between the FULL and ADD marks on the dipstick.

NOTE

If oil level is at or below the ADD mark, add only enough oil to bring the level to the middle of the two marks on the dipstick.

Oil Level Hot Check

NOTES

- *The engine will require a longer warm up period in colder weather.*
- *Engine oil level hot check should be performed only when engine is at normal operating temperature.*

Perform engine oil level **HOT CHECK** as follows:

1. Ride motorcycle until engine is at normal operating temperature.
2. Place vehicle on level ground and rest the vehicle on its jiffy stand (unless sidecar is attached). Allow engine to idle for 1-2 minutes. Turn engine off.
3. Remove filler plug/dipstick and wipe off the dipstick. Insert the dipstick and tighten into the fill spout.

NOTE

The oil level marks for checking with motorcycle upright or on jiffy stand are on the same side of the dipstick. Be sure to use the correct portion of dipstick when checking oil level.

4. See Figure 1-2. Remove the dipstick and note the level of the oil. The level should be between the ADD (1) and FULL (3) marks. Add oil as necessary to bring the level to the FULL mark on the dipstick. Do not overfill.

NOTE

Refer to Table 1-5. Use only recommended oil specified in 1.4 FUEL AND OIL, Engine Lubrication.

5. Start engine and carefully check for oil leaks around drain plug and oil filter.

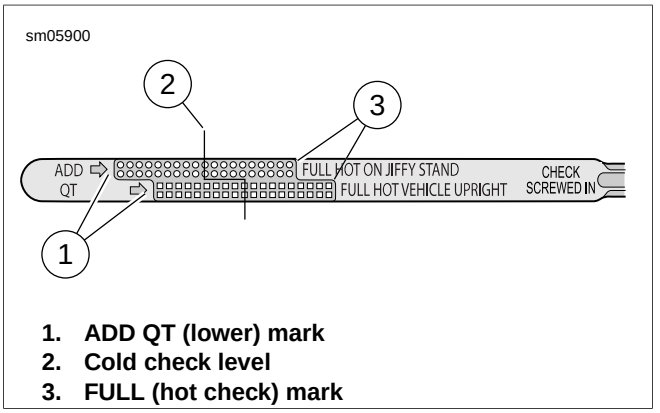
CAUTION

Do not allow hot oil level to fall below Add/Fill mark on dipstick. Doing so can result in equipment damage and/or equipment malfunction. (00189a)

CAUTION

Do not overfill oil tank. Doing so can result in oil carryover to the air cleaner leading to equipment damage and/or equipment malfunction. (00190a)

- Check engine oil level at each complete fuel refill.
- Refer to Table 1-1. Oil should be changed at specified intervals in normal service at warm or moderate temperatures.
- Oil change intervals should be more frequent in cold weather or severe operating conditions. See 1.4 FUEL AND OIL, Winter Lubrication.



1. **ADD QT (lower) mark**
2. **Cold check level**
3. **FULL (hot check) mark**

Figure 1-2. Engine Oil Dipstick

CHANGING OIL AND OIL FILTER

PART NUMBER	TOOL NAME
HD-42311	OIL FILTER WRENCH
HD-44067A	OIL FILTER WRENCH

CAUTION

Do not switch lubricant brands indiscriminately because some lubricants interact chemically when mixed. Use of inferior lubricants can damage the engine. (00184a)

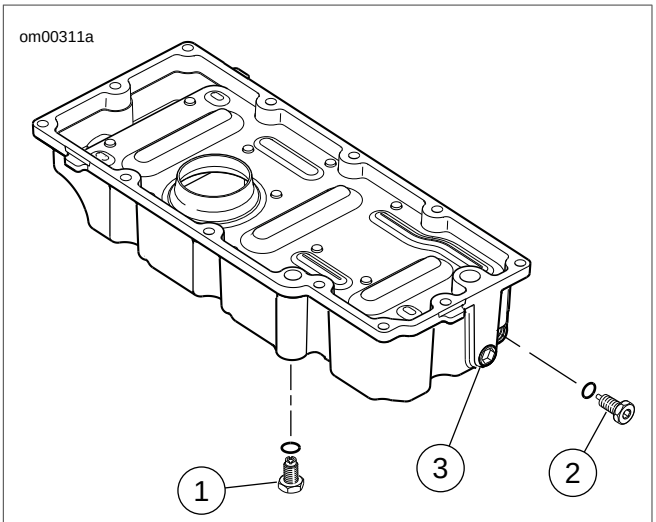
⚠WARNING

Be sure that no lubricants or fluids get on tires, wheels or brakes when changing fluid. Traction can be adversely affected, which could result in loss of control of the motorcycle and death or serious injury. (00047d)

Twin Cam equipped vehicles require the premium oil filter (Part No. 63798-99A Chrome or Part No. 63731-99A Black).

Refer to Table 1-1. Oil should be changed after the first 1000 miles (1600 kilometers) for a new engine and at regular intervals in normal service at warm or moderate temperatures.

1. Ride motorcycle until oil is at normal operating temperature. Turn engine off.
2. Remove filler plug/dipstick.
3. See Figure 1-3. Remove the oil drain plug (2). Do not remove hex plug (3) or transmission drain plug (1). Allow oil to drain completely.



1. **Transmission drain plug (right side)**
2. **Engine oil drain plug and O-ring**
3. **Hex plug (do not remove)**

Figure 1-3. Oil Pan

4. Inspect the oil drain plug o-ring for cuts, tears or signs of deterioration. Replace as necessary.

CAUTION

Use Harley-Davidson oil filter wrench for filter removal. This tool can prevent damage to crankshaft position sensor and/or sensor cable. (00192b)

5. See Figure 1-4. Remove the oil filter using OIL FILTER WRENCH (Part No. HD-42311) or OIL FILTER WRENCH (Part No. HD-44067A) and hand tools. Do not use with air tools.
6. Clean the oil filter mount flange of any old gasket material.

NOTE

Dispose of oil and oil filter in accordance with local regulations.

7. See Figure 1-5. Lubricate gasket with clean engine oil and install **new** oil filter on filter mount. Hand tighten oil filter 1/2-3/4 turn after gasket first contacts filter mounting surface. Do not use OIL FILTER WRENCH (Part No. HD-42311) for oil filter installation.
8. Install engine oil drain plug and tighten to 14-21 ft-lbs (19.0-28.5 Nm).

NOTE

Use the proper grade of oil for the lowest temperature expected before the next oil change. Refer to Table 1-5 for recommended oil.

9. Initially add 3.5 quarts (3.3 liters) of engine oil.

10. Verify proper oil level. See 1.6 ENGINE OIL AND FILTER, Checking Oil Level.
 a. Check engine oil level using **COLD CHECK** procedure.
 b. Start engine and carefully check for oil leaks around drain plug and oil filter.
 c. Check engine oil level using **HOT CHECK** procedure.

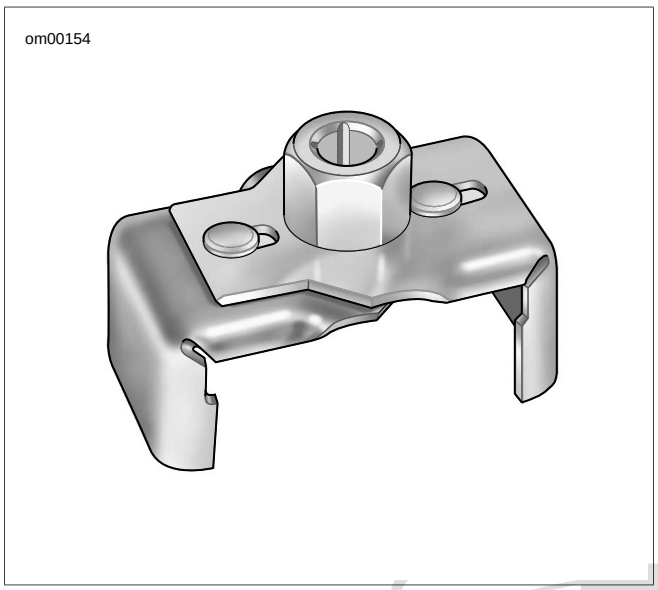
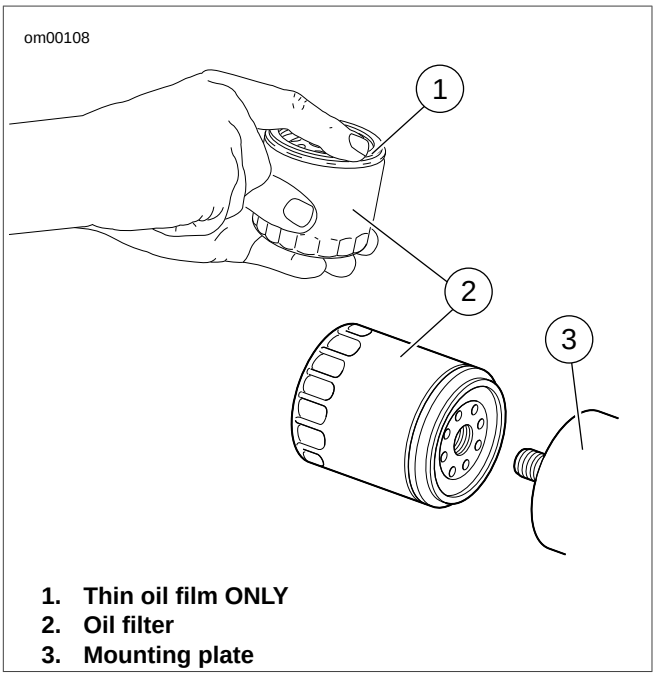


Figure 1-4. Oil Filter Wrench (Part No. HD-42311)



1. **Thin oil film ONLY**
2. **Oil filter**
3. **Mounting plate**

Figure 1-5. Applying Thin Oil Film

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

PRIMARY CHAIN 1.7

GENERAL

All models have an automatic chain tensioner. For primary chain service procedures, see 5.4 DRIVE COMPONENTS.

CHAINCASE LUBRICANT

General

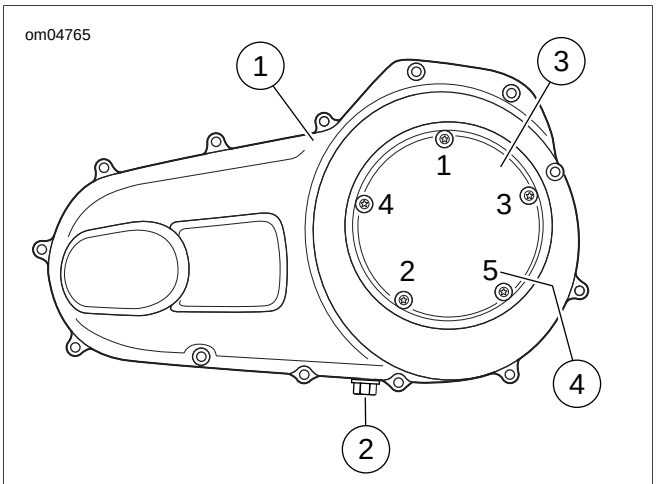
Refer to Table 1-1. The primary chaincase lubricant should be drained and refilled with fresh lubricant at specified intervals.

Check Lubricant Level

1. Ride motorcycle until engine is warmed up to normal operating temperature.
2. Stand vehicle upright on a level surface, so that primary chaincase is level.
3. See Figure 1-6. Remove five screws to free clutch inspection cover from primary chaincase cover.
4. Remove seal ring from clutch inspection cover and discard.
5. If the fluid level can be seen, it is adequate. Otherwise, pour enough GENUINE Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, U.S. quart) in through the clutch inspection cover opening until it is visible along the bottom portion of the clutch assembly.
6. Refer to CHANGING CHAINCASE LUBRICANT to install seal ring and clutch inspection cover.

CAUTION

Do not overfill the primary chaincase with lubricant. Overfilling can cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle. (00199b)



1. **Primary chaincase cover**
2. **Drain plug**
3. **Clutch inspection cover**
4. **Torque sequence**

Figure 1-6. Primary Chaincase

Changing Chaincase Lubricant

CAUTION

When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter the engine. (00198a)

1. Ride motorcycle until engine is warmed up to normal operating temperature.
2. Remove five screws to free clutch inspection cover from primary chaincase cover.
3. Remove drain plug at bottom of primary chaincase. Drain lubricant into suitable container.

NOTE

Dispose of chaincase lubricant in accordance with local regulations.

4. Clean drain plug magnet. If plug has accumulated a lot of debris, inspect the condition of chaincase components.
5. Inspect drain plug O-ring for cuts, tears or signs of deterioration. Replace as necessary.
6. Install drain plug into primary chaincase and tighten to 14-21 ft-lbs (19.0-28.5 Nm).
7. Pour 38 fl. oz. (1124 ml) of GENUINE Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05 quart) through the clutch inspection cover opening.

NOTE

Only add 45 fl. oz. (1331 ml) after service that involves removal of the primary chaincase or primary chaincase cover.

CAUTION

Do not overfill the primary chaincase with lubricant. Overfilling can cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle. (00199b)

WARNING

Be sure that no lubricants or fluids get on tires, wheels or brakes when changing fluid. Traction can be adversely affected, which could result in loss of control of the motorcycle and death or serious injury. (00047d)

8. Swab all lubricant from seal ring groove in clutch inspection cover. Install **new** seal ring in groove with nubs contacting ring groove walls.
9. See Figure 1-6. Install clutch inspection cover to primary chaincase cover. Tighten screws in the sequence shown to 84-108 **in-lbs** (9.5-12.2 Nm).

TRANSMISSION LUBRICANT 1.8

TRANSMISSION LUBRICATION

General

The transmission lubricant level should be checked monthly.

Refer to Table 1-1. The transmission should be drained and refilled with fresh lubricant at specified intervals.

NOTE

When checking the transmission lubricant level, the motorcycle should be leaning on the jiffy stand. Allow a short period of time to equalize lubricant level in the transmission compartments.

Check Lubricant Level

1. Park motorcycle on its jiffy stand.
2. See Figure 1-7. Remove the threaded filler plug/dipstick.
3. See Figure 1-8. Wipe off filler plug/dipstick. Place in filler hole and remove. (Dipstick should rest on lip of filler. Do not screw in.) Lubricant level should be between the full and low marks on the plug/dipstick when removed.

⚠WARNING

Be sure that no lubricants or fluids get on tires, wheels or brakes when changing fluid. Traction can be adversely affected, which could result in loss of control of the motorcycle and death or serious injury. (00047d)

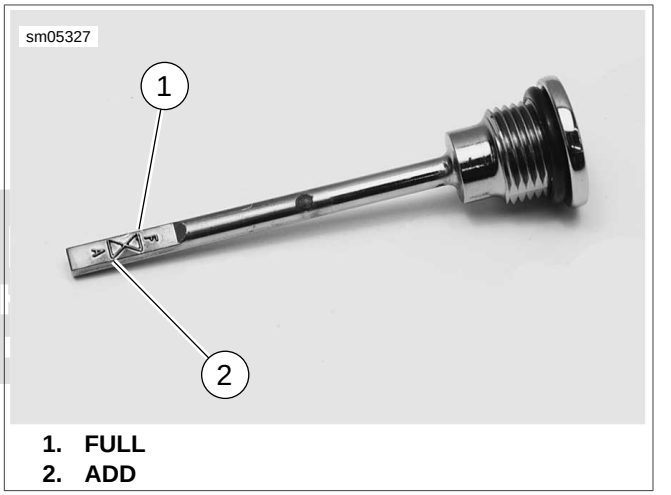
CAUTION

When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter the engine. (00198a)

4. Add lubricant, if necessary. Do not overfill or leakage may occur. When filling the transmission, use GENUINE Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05 quart). The transmission fluid capacity is approximately 32 fluid ounces (0.95 liters).
5. Inspect o-ring for tears or damage. Replace if required. Wipe any foreign material from plug.
6. Install threaded filler/check plug and tighten clockwise to 25-75 **in-lbs** (2.8-8.5 Nm).



Figure 1-7. Transmission Filler Plug/Dipstick Location



1. FULL
2. ADD

Figure 1-8. Transmission Filler Plug/Dipstick Lubricant Level

Changing Transmission Fluid

1. See Figure 1-7. Remove the threaded filler plug/dipstick.

CAUTION

When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter the engine. (00198a)

⚠WARNING

Be sure that no lubricants or fluids get on tires, wheels or brakes when changing fluid. Traction can be adversely affected, which could result in loss of control of the motorcycle and death or serious injury. (00047d)

2. See Figure 1-3. Remove transmission drain plug (1) and drain lubricant into a suitable container.

NOTE

Dispose of transmission lubricant in accordance with local regulations.

3. Inspect the drain plug o-ring for tears or damage. Replace if required. Wipe any foreign material from plug.
4. Install drain plug and tighten to 14-21 ft-lbs (19.0-28.5 Nm). Fill the transmission with 32 fl. oz. (0.95 liters) of GENUINE Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05 quart).

NOTE

Do not overfill or leakage may occur. The transmission fluid capacity is approximately 32 fl. oz. (0.95 liters).

5. Install threaded filler plug/dipstick and tighten clockwise to 25-75 **in-lbs** (2.8-8.5 Nm).
6. Start engine and carefully check for oil leaks around drain plug.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

AIR CLEANER AND EXHAUST SYSTEM 1.9

REMOVAL

1. See Figure 1-9. Remove screw (1) and air cleaner cover with rubber seal (3).
2. Remove three screws (4) to release cover bracket (5) from filter element.
3. Remove filter element (6) pulling two breather tubes (8) from holes on inboard side.
4. Remove and discard gasket (7).
5. Remove breather tubes from breather bolts.
6. Inspect the breather tubes and rubber seal for cuts, tears, holes or signs of deterioration. Replace as necessary.

⚠WARNING

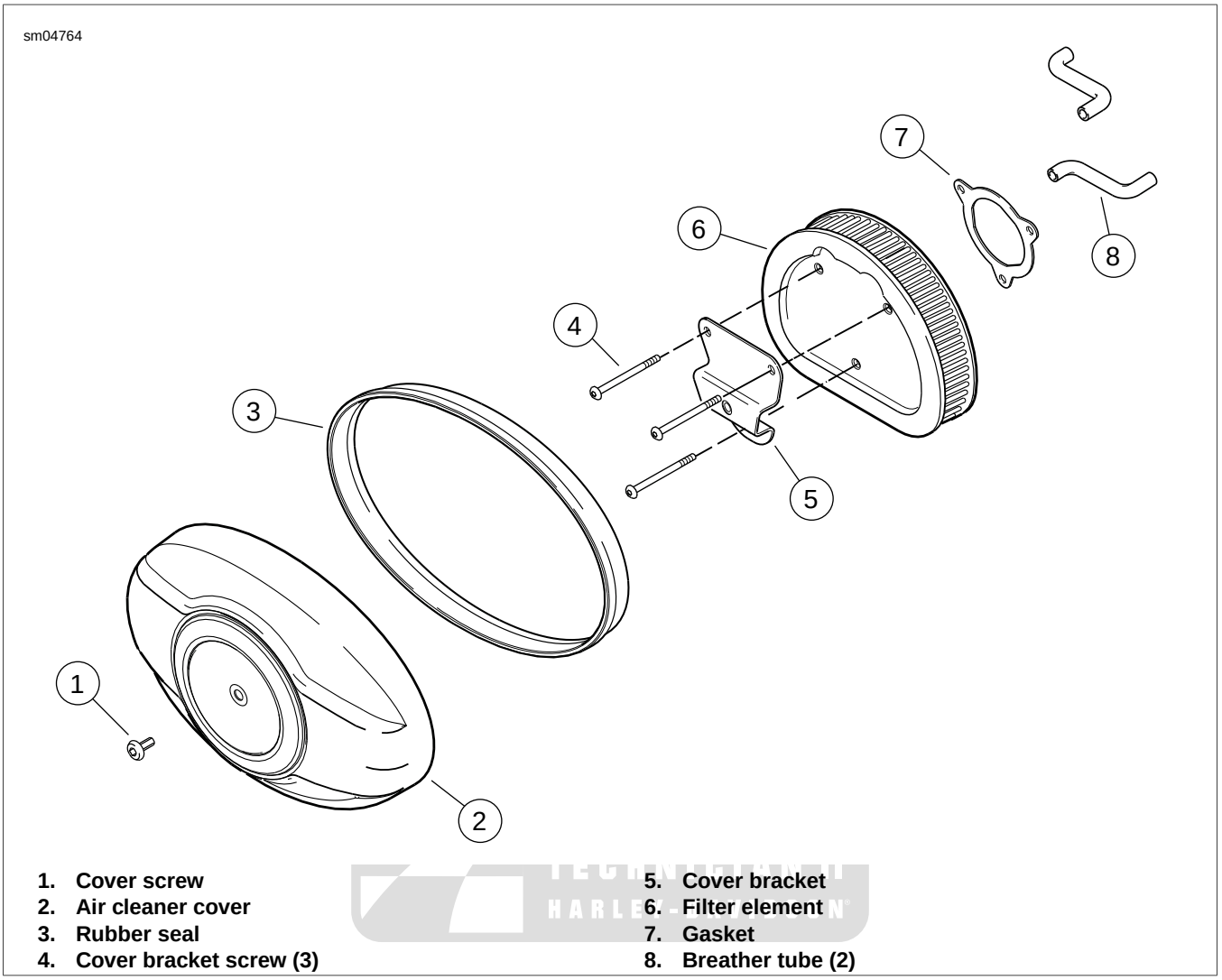
Do not use gasoline or solvents to clean filter element. Flammable cleaning agents can cause an intake system fire, which could result in death or serious injury. (00101a)

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

7. Clean filter element.
 a. Wash the paper/wire mesh filter element (and breather tubes) in lukewarm water with a mild detergent. Do not strike filter element on a hard surface to dislodge dirt.
 b. Allow filter element to either air dry or blow it dry, from the inside, with low pressure air. Do NOT use air cleaner filter oil on the Harley-Davidson paper/wire mesh air filter element.
 c. Hold the filter element up to a strong light source. The element is sufficiently clean if light is uniformly visible through the media.
 d. Replace the filter element if damaged or if filter media cannot be adequately cleaned.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®



1. **Cover screw**
2. **Air cleaner cover**
3. **Rubber seal**
4. **Cover bracket screw (3)**
5. **Cover bracket**
6. **Filter element**
7. **Gasket**
8. **Breather tube (2)**

Figure 1-9. Air Cleaner Assembly

INSTALLATION

1. Install **new** gasket (7) on air filter element.
2. Insert breather tubes approximately 0.25 inch (6.4 mm) into holes on inboard side of filter element.

NOTE

Air cleaner mounting without installation of the breather tubes allows crankcase vapors to be vented into the atmosphere in violation of legal emissions standards.

3. Install breather tubes onto breather bolts.
4. Place filter element onto backplate with the flat side down.
5. Install cover bracket and start screws (4). Tighten screws to 40-60 **in-lbs** (4.5-6.8 Nm).
6. Verify that rubber seal is properly seated around perimeter of air cleaner cover.
7. Fit air cleaner cover into backplate. Apply a small dab of LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (BLUE) to threads of cover screw. Install screw and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).

EXHAUST SYSTEM LEAK CHECK

Check the exhaust system for leaks at every scheduled service interval as follows:

1. Check entire exhaust system for loose or missing fasteners, broken pipe clamps or brackets, and obvious signs of leakage (carbon tracks at pipe joints, etc.).
2. Check for loose or broken heat shields. Repair or replace as necessary.
3. Start engine, cover muffler ends with clean, dry shop towels and listen for audible signs of exhaust leakage.
4. Correct any leaks detected. See 4.19 EXHAUST SYSTEM for exhaust system removal and installation procedures.

TIRES AND WHEELS 1.10

TIRES

WARNING

Match tires, tubes, air valves and caps to the correct wheel rim. Contact a Harley-Davidson dealer. Mismatching can result in damage to the tire bead, allow tire slippage on the rim or cause tire failure, which could result in death or serious injury. (00023a)

WARNING

Use only Harley-Davidson approved tires. See a Harley-Davidson dealer. Using non-approved tires can adversely affect stability, which could result in death or serious injury. (00024a)

WARNING

Use inner tubes on laced (wire spoked) wheels. Using tubeless tires on laced wheels can cause air leaks, which could result in death or serious injury. (00025a)

NOTES

- *Tubeless tires fitted with the correct size inner tubes may be used on all Harley-Davidson laced (wire spoked) wheels. Protective rubber rim strips must be used with tubeless tires (fitted with correct size inner tubes) when mounted on laced (wire spoked) wheels.*
- *Inner tubes must not be used in radial tires and radial tires must not be used on laced (wire spoked) wheels.*
- *Tubeless tires are used on all Harley-Davidson cast and disc wheels.*
- *Tire sizes are molded on the tire sidewall. Inner tube sizes are printed on the tube.*
- *New tires should be stored on a horizontal tire rack. Avoid stacking new tires in a vertical stack. The weight of the stack compresses the tires and closes down the beads.*

Check tire pressure and tread:

- As part of the pre-ride inspection.
- At every scheduled service interval.

1. Inspect each tire for punctures, cuts and breaks.
2. Inspect each tire for wear. Replace tires before they reach the tread wear indicator bars.

NOTE

Missing indicator wear bars represent less than 1/32 in. (0.8 mm) tread pattern depth remaining.

3. Check for proper front and rear tire pressures when tires are cold. Compare results against Table 1-7.

Table 1-7. Tire Pressures: 2009 Touring Models

MODEL	TIRE PRESSURE (COLD)			
	FRONT		REAR	
	PSI	kPa	PSI	kPa
All	36	248	40	276

TIRE REPLACEMENT

Inspection

WARNING

Harley-Davidson tires are equipped with wear bars that run horizontally across the tread. When wear bars become visible and only 1/32 in. (0.8 mm) tread depth remains, replace tire immediately. Using a worn tire can adversely affect stability and handling, which could result in death or serious injury. Use only Harley-Davidson approved replacement tires. (00090b)

See Figure 1-10. Arrows on tire sidewalls pinpoint location of wear bar indicators.

Tread wear indicator bars will appear on tire tread surfaces when 1/32 in. (0.8 mm) or less of tire tread remains. See Figure 1-11. Always replace tires before the tread wear indicator bars appear.

When To Replace Tires

New tires are needed if any of the following conditions exist:

1. Tread wear indicator bars become visible on the tread surfaces.
2. Tire cords or fabric become visible through cracked sidewalls, snags or deep cuts.
3. A bump, bulge or split in the tire.
4. Puncture, cut or other damage to the tire that cannot be repaired.

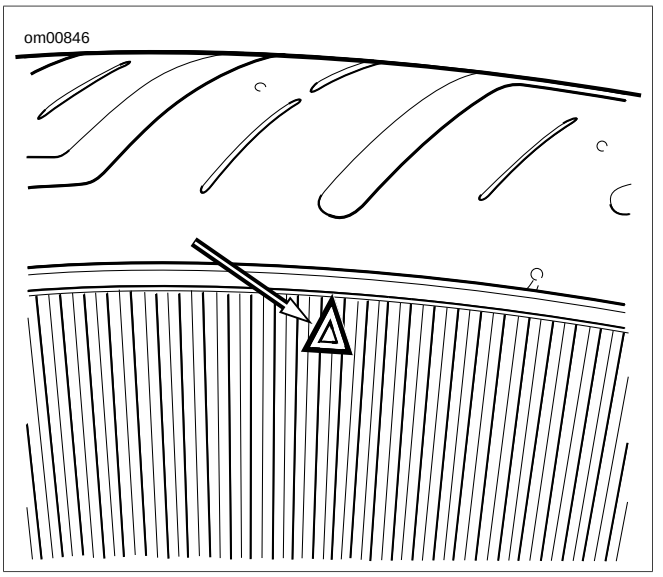


Figure 1-10. Tire Sidewall Wear Bar Locator

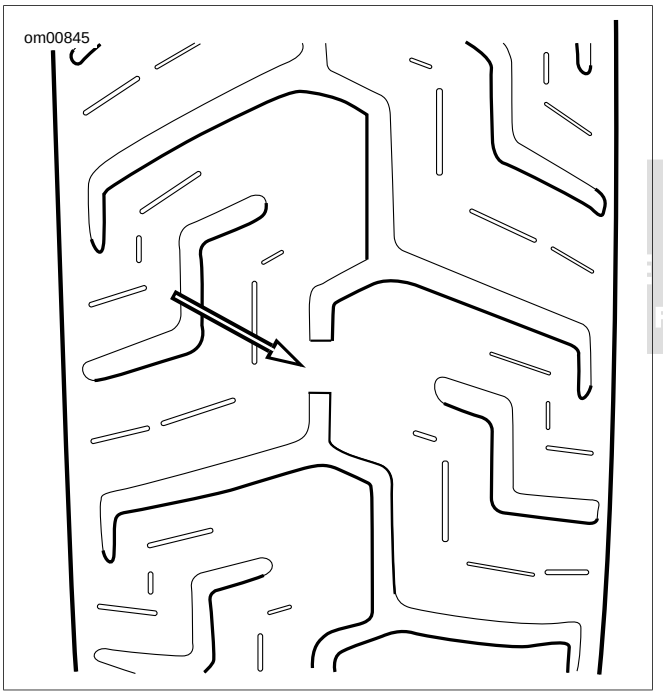


Figure 1-11. Wear Bar Appearance (Typical)

WHEEL BEARINGS

Service wheel bearings:

1. Check wheel bearings as outlined in 2.11 SEALED WHEEL BEARINGS. Replace wheel bearings if end play exceeds 0.002 in. (0.051 mm).
2. If wheel is already removed, check wheel bearings as follows:
 a. See Figure 1-12. Insert finger into wheel bearing and rotate the inner race in both directions. Repeat step on opposite side of wheel.
 b. Replace the wheel bearings if there is drag, rough rotation, abnormal noise or anything unusual.
3. Check axle spacers for wear and corrosion. Replace as necessary.

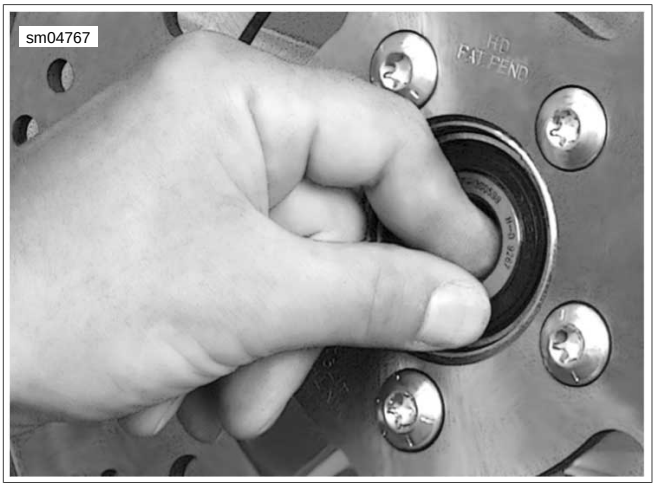


Figure 1-12. Inspect Wheel Bearings

WHEEL SPOKES

⚠WARNING

Spokes that are too tight can draw nipples through the rim or distort hub flanges. Spokes that are too loose can continue to loosen when put in service. Either condition can adversely affect stability and handling, which could result in death or serious injury. (00286a)

CAUTION

If nipples require more than one full turn to tighten spoke, remove tire to check that spoke protrusion has not damaged tube. (00526b)

1. Raise motorcycle wheel off the ground.

NOTE

Perform the entire procedure for each spoke, one at a time.

2. Mark one of the spokes with a reference mark to the rim.
3. Loosen spoke 1/4 turn.

NOTES

- *Use a spoke torque wrench to tighten spokes.*
- *Do not tighten spoke more than 1/4 turn past reference mark. If more tension is needed, label spoke and check after completing rest of wheel.*

4. Tighten spoke to reference mark. If torque is less then the value listed in Table 1-8, continue to tighten spoke until it reaches the listed torque.

5. Once the entire wheel has been checked, repeat procedure for each labeled spoke.
6. If more than a few spokes were loose, true the entire wheel following procedure under 2.12 TRUING LACED WHEELS.

Table 1-8. Spoke Nipple Torque Specification

RIM TYPE	MINIMUM TORQUE
All	55 **in-lbs** (6.2 Nm)

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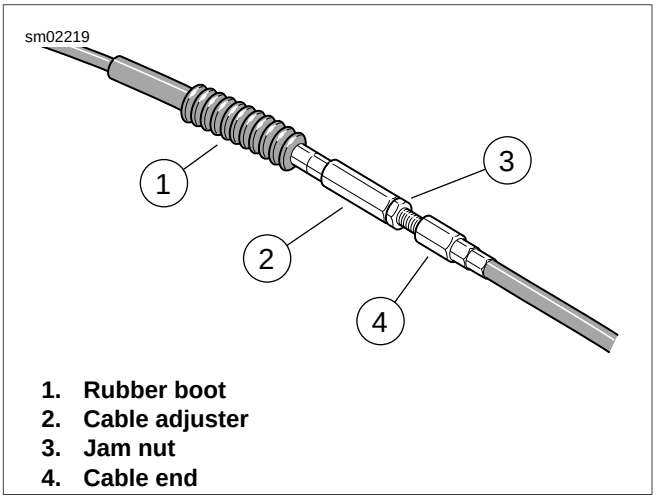
CLUTCH 1.11

ADJUSTMENT

NOTE

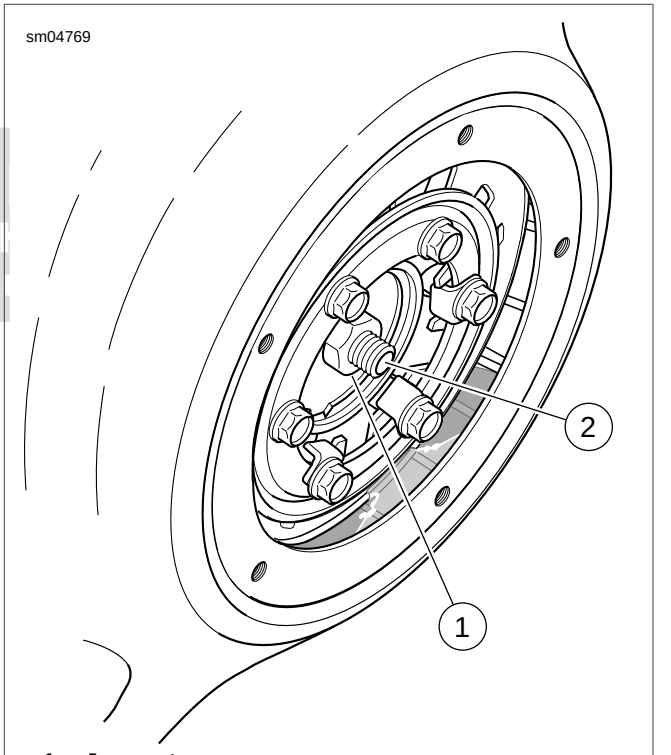
Perform the clutch adjustment with the motorcycle at room temperature. The clearance at the adjuster screw will increase as the powertrain temperature increases. If adjuster screw is adjusted with powertrain hot, clearance at push rod bearing could be insufficient with powertrain cold and clutch slippage could occur.

1. Stand motorcycle upright and level.
2. Remove clutch inspection cover from primary chaincase cover.
3. Remove seal ring from clutch inspection cover and discard.
4. See Figure 1-13. Add freeplay to cable.
 a. Slide rubber boot (1) off cable adjuster.
 b. Loosen jam nut (3) and back away from cable adjuster.
 c. Move adjuster (2) toward jam nut to introduce a large amount of free play at hand lever.
5. See Figure 1-14. Loosen jam nut (1) on clutch adjuster screw. Turn adjuster screw (2) inward (clockwise) until lightly seated.
6. Back out adjuster screw 1/2 to 1 full turn. While holding adjuster screw, tighten jam nut to 72-120 **in-lbs** (8.1-13.6 Nm).
7. Squeeze clutch lever to maximum limit three times to set ball and ramp release mechanism.
8. See Figure 1-13. Check freeplay.
 a. Turn cable adjuster (2) away from jam nut (3) until slack is eliminated at hand lever.
 b. See Figure 1-15. Pull clutch cable ferrule (2) away from clutch lever bracket to check free play. Turn cable adjuster as necessary to obtain 1/16-1/8 in. (1.6-3.2 mm) free play between end of cable ferrule and clutch lever bracket.
9. Hold adjuster and tighten jam nut against cable adjuster. Cover cable adjuster mechanism with rubber boot.
10. Swab all lubricant from seal ring groove in clutch inspection cover. Install **new** seal ring in groove with nubs contacting ring groove walls.
11. Fasten clutch inspection cover to primary chaincase cover. Alternately tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm) in the sequence shown in Figure 1-6.



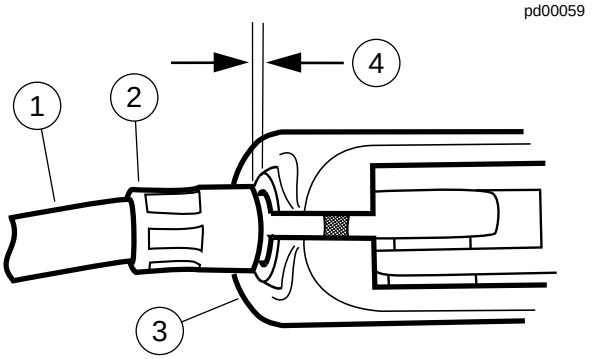
1. Rubber boot
2. Cable adjuster
3. Jam nut
4. Cable end

Figure 1-13. Clutch Cable Adjuster



1. Jam nut
2. Clutch adjuster screw

Figure 1-14. Clutch Adjuster Screw



1. Clutch cable
2. Cable ferrule
3. Clutch lever bracket
4. 1/16-1/8 in. (1.6-3.2 mm)

Figure 1-15. Clutch Hand Lever

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

REAR BELT AND SPROCKETS 1.12

GENERAL

When a drive belt is replaced for any reason other than stone damage, it is recommended that the transmission and rear sprockets also be replaced to increase the longevity of the new drive belt. In the case of stone damage, inspect sprockets for damage and replace as required.

⚠WARNING

Never bend belt forward into a loop smaller than the drive sprocket diameter. Never bend belt into a reverse loop. Over bending can damage belt resulting in premature failure, which could cause loss of control and death or serious injury. (00339a)

CLEANING

Keep dirt, grease, oil, and debris off the belt and sprockets. Clean the belt with a rag slightly dampened with a light cleaning agent.

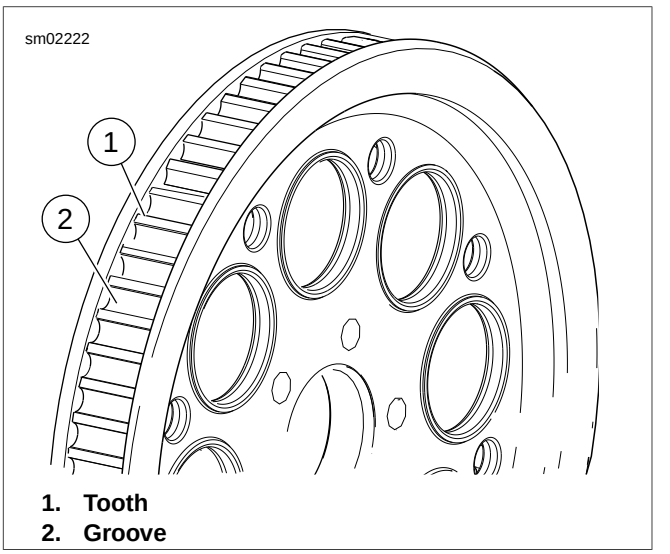
INSPECTION

Sprockets

NOTE

If chrome chips or gouges to rear sprocket are large enough to be harmful, they will leave a pattern on the belt face.

1. See Figure 1-16. Inspect each tooth (1) of rear sprocket for:
 a. Major tooth damage.
 b. Large chrome chips with sharp edges.
 c. Gouges caused by hard objects.
 d. Excessive loss of chrome plating (see next step).
2. To check if chrome plating has worn off, drag a scribe or sharp knife point across the bottom of a groove (2) (between two teeth) with medium pressure.
 a. If scribe or knife point slides across groove without digging in or leaving a visible mark, chrome plating is still good.
 b. If scribe or knife points digs in and leaves a visible mark, it is cutting the bare aluminum. A knife point will not penetrate the chrome plating.
3. Replace rear sprocket if major tooth damage or loss of chrome exists.



1. Tooth
2. Groove

Figure 1-16. Rear Sprocket

Rear Belt

See Figure 1-17. Inspect drive belt for:

- Cuts or unusual wear patterns.
- Outside edge bevelling (8). Some bevelling is common, but it indicates that sprockets are misaligned.
- Outside ribbed surface for signs of stone puncture (7). If cracks/damage exists near edge of belt, replace belt immediately. Damage to center of belt will require belt replacement eventually, but when cracks extend to edge of belt, belt failure is imminent.
- Inside (toothed portion) of belt for exposed tensile cords (normally covered by nylon layer and polyethylene layer). This condition will result in belt failure and indicates worn transmission sprocket teeth. Replace belt and transmission sprocket.
- Signs of puncture or cracking at the base of the belt teeth. Replace belt if either condition exists.
- Replace belt if conditions 2, 3, 6 or 7 (on edge of belt) exist.

NOTE

Condition 1 may develop into 2 or 3 over time. Condition 1 is not grounds for replacing the belt, but it should be watched closely before condition 2 develops which will require belt replacement.

DIGITAL TECHNICIAN II HARLEY

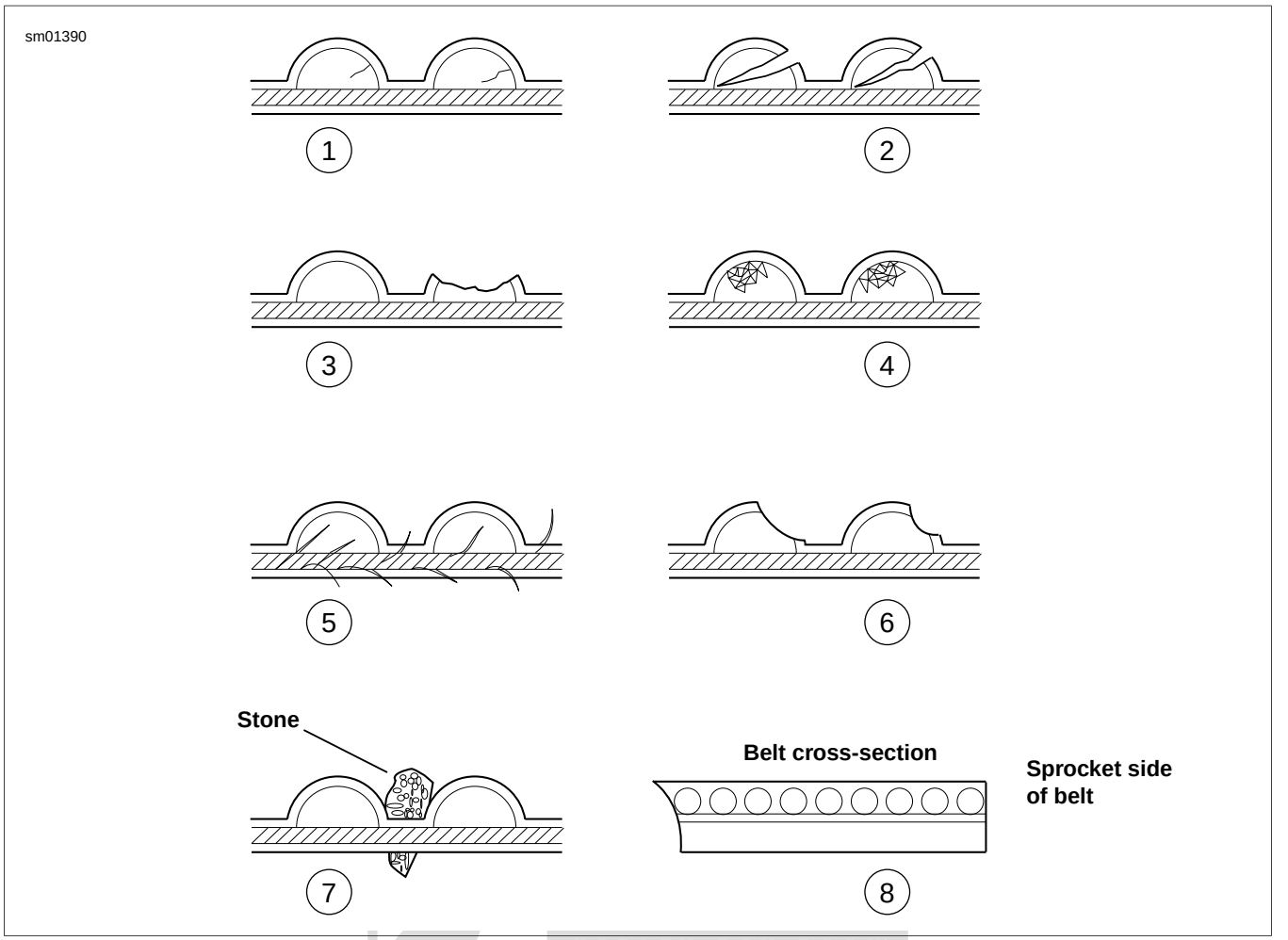


Figure 1-17. Drive Belt Wear Patterns

Table 1-9. Drive Belt Wear Analysis

PATTERN	CONDITION	REQUIRED ACTION
1	Internal tooth cracks (hairline)	OK to run, but monitor condition.
2	External tooth cracks	Replace belt.
3	Missing teeth	Replace belt.
4	Chipping (not serious)	OK to run, but monitor condition.
5	Fuzzy edge cord	OK to run, but monitor condition.
6	Hook wear	Replace belt and sprocket.
7	Stone damage	Replace belt if damage is on the edge.
8	Bevel wear (outboard edge only)	OK to run, but monitor condition.

REAR BELT DEFLECTION 1.13

CHECKING BELT DEFLECTION

PART NUMBER	TOOL NAME
HD-35381A	BELT TENSION GAUGE

NOTE

Always use BELT TENSION GAUGE (Part No. HD-35381A) to measure belt deflection. Do not rely on "feel" as this can result in belts that are under tensioned. Loose belts will fail due to "ratcheting" (jumping a tooth) with resultant tensile cord crimping and breakage.

Check rear belt deflection:

- As part of pre-ride inspection.
- At every scheduled service interval.
- With transmission in neutral.
- At loosest spot in belt.
- With motorcycle at ambient temperature.
- With motorcycle upright and rear wheel off the ground or on jiffy stand without rider or luggage.

1. Remove left side saddlebag.
2. See Figure 1-18. Obtain BELT TENSION GAUGE (Part No. HD-35381A).
3. Slide O-ring toward 0 lbs (0 kg) mark.
4. See Figure 1-19. Fit cradle against bottom of belt half way between transmission and rear wheel compensator sprockets.
5. While observing belt deflection through the window on the debris deflector, push upward on knob until O-ring slides down to the 10 lbs (4.5 kg) mark.

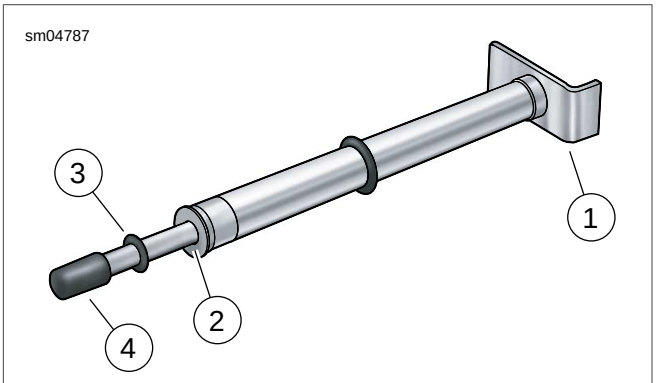
NOTE

Each graduation on scale represents 1/8 in. (3.2 mm) of belt deflection.

6. Rotate rear wheel and measure deflection at different spots on the belt. Compare results with specifications in Table 1-10.
 a. If deflection is within specification, install left side saddlebag.
 b. If deflection is not within specification, see 1.13 REAR BELT DEFLECTION, Setting Belt Deflection.

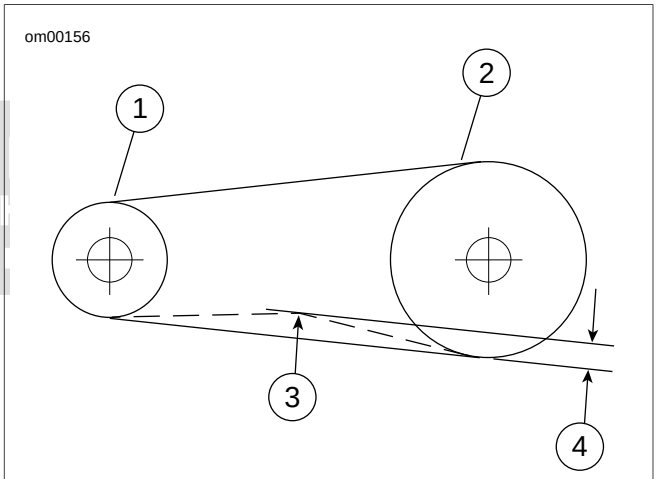
Table 1-10. Belt Deflection

MODEL	INCHES	MILLIMETERS
FLHX	1/4-5/16	6.4-7.9
Other models	3/8-7/16	9.5-11.1



1. **Cradle**
2. **0 lbs (0 kg) mark**
3. **O-ring**
4. **Knob**

Figure 1-18. Belt Tension Gauge



1. **Transmission sprocket**
2. **Rear wheel sprocket**
3. **10 lbs (4.5 kg) of force**
4. **Amount of deflection**

Figure 1-19. Checking Belt Deflection

SETTING BELT DEFLECTION

PART NUMBER	TOOL NAME
HD-35381A	BELT TENSION GAUGE
HD-47925	AXLE NUT TORQUE ADAPTER

Adjustment

1. Remove both saddlebags.
2. Remove and discard E-clip from groove at end of axle.

NOTE

The AXLE NUT TORQUE ADAPTER simplifies the belt adjustment procedure by allowing the cone nut to be loosened

and tightened without having to remove the right side muffler. The tool also can be used to rotate the weld nut on the left side.

3. See Figure 1-20. Install AXLE NUT TORQUE ADAPTER (Part No. HD-47925) on 1/2 inch breaker bar, perpendicular to breaker bar. For best clearance with muffler, install torque adapter on the outboard side.

NOTE

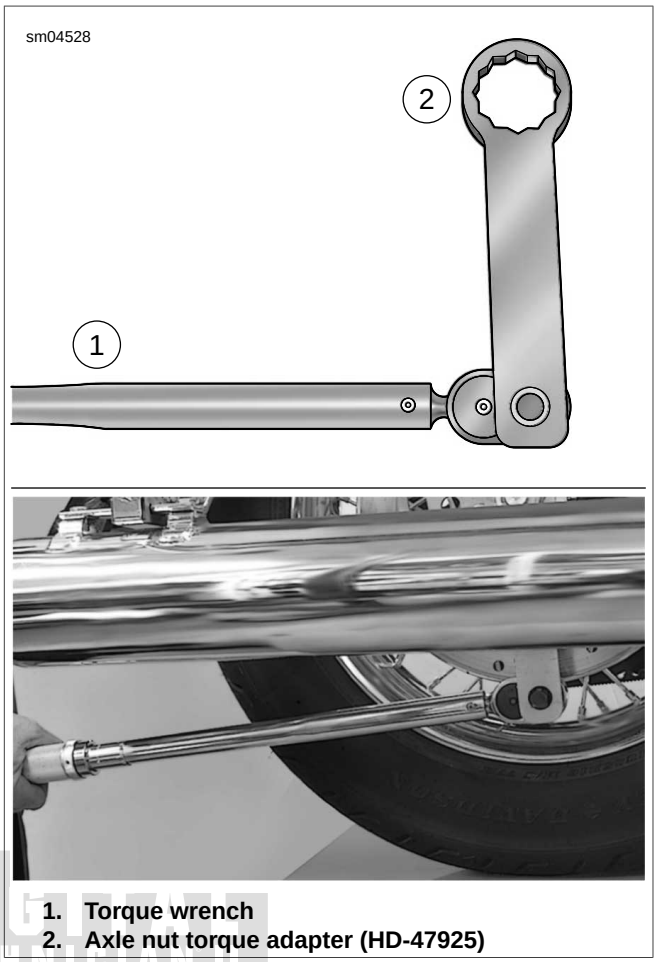
In order to provide adequate room to install tools on the cone nut and weld nut, it may be necessary to remove bolts fastening each muffler to the rear of the saddlebag frame and pulling each muffler away from the end of the axle.

4. Insert tool up between rear wheel and muffler and onto cone nut. Loosen cone nut.

NOTE

Since any added length can act as a torque multiplier, the torque wrench must be perpendicular to the torque adapter.

5. Install AXLE NUT TORQUE ADAPTER (Part No. HD-47925) on torque wrench, perpendicular to torque wrench.
6. Insert tool up between rear wheel and muffler to capture cone nut.
7. See Figure 1-21. Push wheel forward and verify that cam (5) contacts boss (4) on both sides of rear fork.
8. For purposes of adjustment only, snug the cone nut (6) to 15-20 ft-lbs (20-27 Nm).
9. Use BELT TENSION GAUGE (Part No. HD-35381A) to check belt deflection as adjustment is made. See 1.13 REAR BELT DEFLECTION, Checking Belt Deflection.



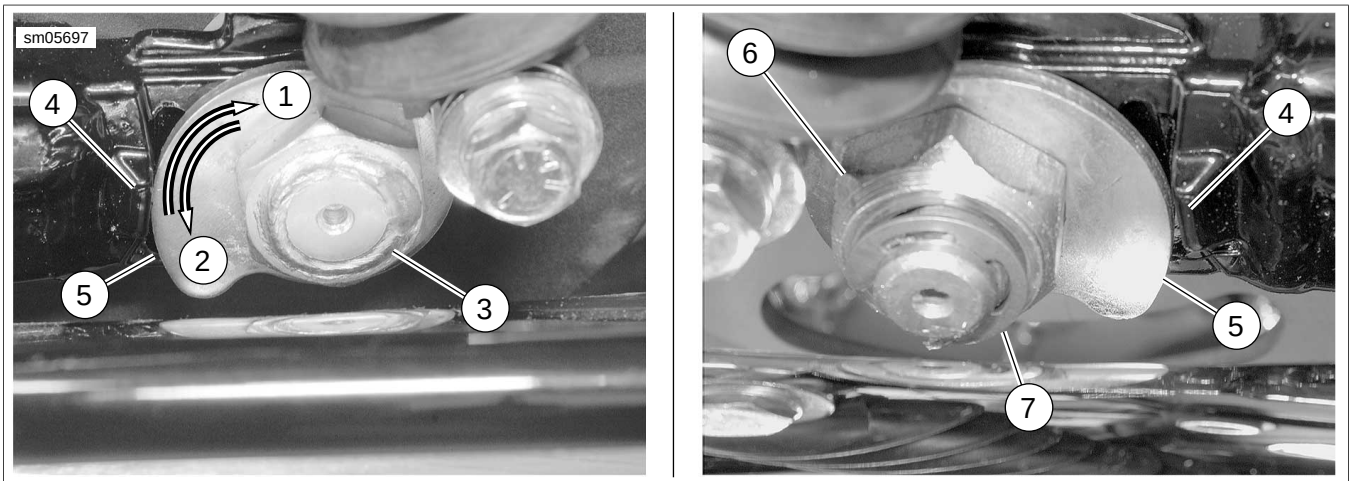
1. **Torque wrench**
2. **Axle nut torque adapter (HD-47925)**

Figure 1-20. Install Tool Perpendicular to Torque Wrench

NOTE

It may be beneficial to use a second AXLE NUT TORQUE ADAPTER (Part No. HD-47925) and breaker bar or ratchet to rotate and hold the weld nut. The position of the breaker bar or ratchet in relation to the tool is not important and can be mated in any position that will make use easy.

10. See Figure 1-21. Adjust belt tension by rotating weld nut (3) on left side of axle; clockwise to tighten the belt or counterclockwise to loosen the belt. If loosening the belt tension, push the wheel forward and verify both cams (5) touch the bosses (4) on both sides after the weld nut is rotated.
11. When correct tension is obtained, verify the cams touch the bosses on both sides of the rear fork.



1. **Increase belt deflection**
2. **Reduce belt deflection**
3. **Weld nut**
4. **Weld nub**
5. **Adjuster cam**
6. **Cone nut**
7. **E-clip**

Figure 1-21. Rear Wheel Adjuster Cams

Assembly

NOTE

It is important that the weld nut does not rotate once belt tension is correct. If the axle moves during tightening of the cone nut, the belt deflection procedure must be restarted.

1. Hold weld nut and tighten cone nut to 95-105 ft-lbs (128.8-142.4 Nm).
2. Again, verify the cams touch the bosses on both sides of the rear fork. Check belt deflection to verify that it is still within specification.
3. With the flat side out, install **new** E-clip in groove on right side of axle.
4. If removed, install fasteners that attach mufflers to the saddlebag frames and tighten to 96-144 **in-lbs** (10.9-16.3 Nm).
5. Install saddlebags.

DIGITAL TECHNICIAN HARLEY-DAVIDSON

FLUID INSPECTION

⚠CAUTION

Direct contact of D.O.T. 4 brake fluid with eyes can cause irritation. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts of D.O.T. 4 brake fluid can cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN. (00240a)

CAUTION

D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)

CAUTION

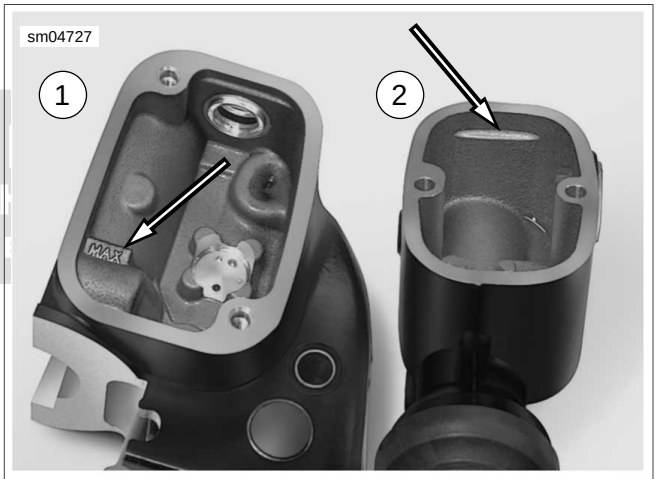
Do not allow dirt or debris to enter the master cylinder reservoir. Dirt or debris in the reservoir can cause improper operation and equipment damage. (00205c)

1. Check level in rear master cylinder reservoir.
 a. Stand motorcycle upright, so that master cylinder reservoir is level.
 b. Remove two screws to release cover from master cylinder reservoir.
 c. See Figure 1-22. Check brake fluid level. If necessary, add D.O.T. 4 BRAKE FLUID until level is flush with top of ledge cast at front of reservoir.
 d. Install master cylinder reservoir cover and tighten screws to 12-15 **in-lbs** (1.4-1.7 Nm).
2. Check level in front master cylinder reservoir.
 a. Turn front wheel toward left fork stop until front master cylinder reservoir is level.
 b. Remove cover from master cylinder reservoir.
 c. See Figure 1-22. Check brake fluid level. If necessary, add D.O.T. 4 BRAKE FLUID until level is flush with step (marked MAX) cast at rear of reservoir.
 d. Install master cylinder reservoir cover. Install cover screws and tighten to 7-10 **in-lbs** (0.8-1.1 Nm).

⚠WARNING

After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

3. Verify that front brake lever and rear brake pedal have a firm feel when applied. Bleed appropriate system if brake feels spongy. See 1.16 BLEEDING BRAKES.



1. **Front master cylinder reservoir**
2. **Rear master cylinder reservoir**

Figure 1-22. Brake Fluid Level

BRAKE PADS AND DISCS 1.15

INSPECTION

Check brake pads and discs:

- At every scheduled service interval.
- Whenever the components are removed during service procedures.

Brake Pads

⚠CAUTION

Direct contact of D.O.T. 4 brake fluid with eyes can cause irritation. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts of D.O.T. 4 brake fluid can cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN. (00240a)

CAUTION

D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)

⚠WARNING

Always replace brake pads in complete sets for correct and safe brake operation. Improper brake operation could result in death or serious injury. (00111a)

Replace both rear brake pads (inner and outer) if the friction material of either pad is worn to 0.016 in. (0.4 mm) or less above the backing plate.

Replace all front brake pads (inner and outer pads of both the left and right side calipers) if the friction material of any single pad is worn to 0.016 in. (0.4 mm) or less above the backing plate.

NOTE

Refer to the wear indicator lines for a general indication of pad wear. See Figure 1-24.

Always install a **new** pad pin (provided in brake pad service kit) whenever the brake pads are replaced.

Inspect the brake lines and hoses for damage or wear.

Brake Disc Thickness

The minimum front brake disc thickness is 0.18 in. (4.5 mm) and is stamped on the side of the disc.

The minimum rear brake disc thickness is 0.25 in. (6.3 mm) and is stamped on the side of the disc.

Replace any disc that is excessively worn or badly scored.

Brake Disc Lateral Runout

Maximum brake disc lateral runout or warpage is 0.008 in. (0.2 mm) when measured near the outside diameter of the disc.

BRAKE PAD REPLACEMENT

Rear Brake Caliper

1. Remove right side saddlebag. See 2.29 SADDLEBAGS, Removal.
2. If ABS equipped, carefully cut cable strap to release rear wheel speed sensor cable from brake hose to brake caliper.
3. Remove two screws to release brake caliper from caliper bracket.
4. Remove brake caliper from brake disc.

NOTE

Do not operate the brake pedal with the rear brake caliper removed or the caliper pistons may be forced out. Reseating pistons requires caliper disassembly.

5. Stand motorcycle upright, so that rear master cylinder reservoir is level. Wrap a clean shop cloth around the outside of the reservoir to protect paint from brake fluid spills.
6. Remove two screws to release cover from master cylinder reservoir.

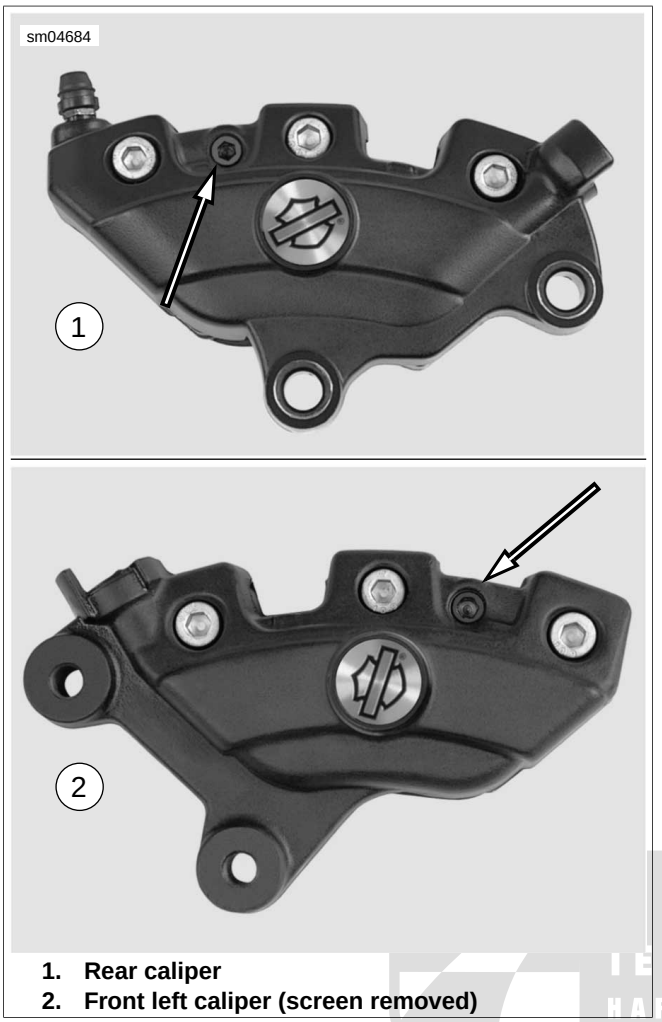
NOTE

Fluid level will rise as pistons are pushed back into the caliper, possibly overflowing the master cylinder reservoir. Remove some fluid from the reservoir if necessary.

7. Alternately push each pad back until pistons are fully seated in the bores.
8. See Figure 1-26. Pull retaining clip from groove in pad pin.
9. See Figure 1-23. Remove pad pin (metric).
10. Pull on pad pin side of brake pads to release from caliper.
11. Remove pad spring if damaged or worn.
12. If removed, seat **new** pad spring on flat in caliper, so that clips on spring engage indentations in caliper. Be sure that forked end of pad spring is on the pad pin side of the caliper.

⚠WARNING

Always replace brake pads in complete sets for correct and safe brake operation. Improper brake operation could result in death or serious injury. (00111a)



1. **Rear caliper**
2. **Front left caliper (screen removed)**

Figure 1-23. Brake Caliper Pad Pin

13. Install **new** brake pads as follows:
 a. See Figure 1-24. Hold inner brake pad, so that pad pin tab is on the same side as pad pin hole in caliper.
 b. See Figure 1-25. Insert opposite side of brake pad into caliper engaging square shaped corner of pad in slot of caliper.
 c. Push pad pin tab side of brake pad into caliper until seated.
 d. Verify that brake pad friction material faces brake disc gap in caliper.
 e. Repeat step to install outer brake pad.
14. Turn caliper over. Verify that pad pin tabs are centered under forks of pad spring. Adjust pads if necessary.
15. Install **new** pad pin and tighten to 75-102 **in-lbs** (8.5-11.5 Nm).
16. See Figure 1-26. Install retaining clip in groove of pad pin, so that lip overhangs caliper housing.
17. Install brake caliper onto brake disc. Align holes in brake caliper with those in caliper bracket and install two screws. Alternately tighten screws to 43-48 ft-lbs (58.3-65.1 Nm).
18. If ABS equipped, install **new** cable strap 1.25 in. (31.8 mm) in front of the brake hose crimp capturing rear wheel speed sensor cable and brake hose.

WARNING

After servicing brakes and before moving motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00279a)

19. Depress brake pedal several times to set brake pads to proper operating position within caliper.
20. See Figure 1-27. Check brake fluid level in master cylinder reservoir. If necessary, add D.O.T. 4 BRAKE FLUID until level is flush with ledge cast at front of reservoir.
21. Install master cylinder reservoir cover. Install cover screws and tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
22. Install right side saddlebag. See 2.29 SADDLEBAGS, Installation.

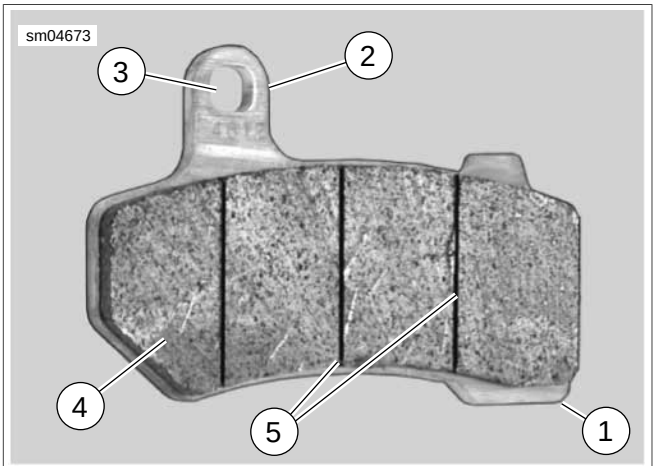
WARNING

After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

23. Test brake system.
 a. Turn ignition switch ON. Depress brake pedal to verify operation of brake lamp.
 b. Test ride motorcycle. Bleed the system if brakes feel spongy. See 1.16 BLEEDING BRAKES.

NOTE

*Avoid making hard stops for the first 100 miles (160 km). This allows the **new** pads to become conditioned to the brake discs.*

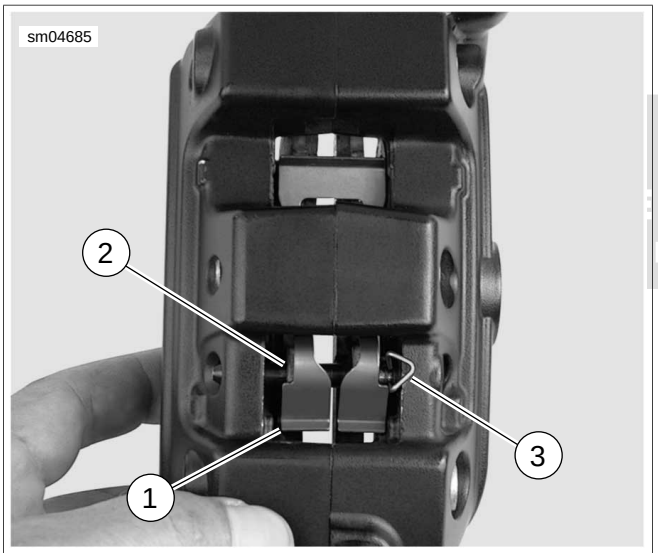


1. **Square corner**
2. **Pad pin tab**
3. **Pad pin hole**
4. **Friction material**
5. **Wear indicator lines**

Figure 1-24. Brake Pad



Figure 1-25. Brake Caliper (Bottom View)



1. **Pad spring (forked end)**
2. **Pad pin tab**
3. **Pad pin retaining clip**

Figure 1-26. Brake Caliper (Top View)

Front Brake Calipers

1. If present, carefully cut two cable straps to release front wheel speed sensor cable and front fender tip lamp wires from brake hose to left brake caliper.
2. On ABS equipped motorcycles, release front wheel speed sensor cable from clip as follows:
 a. Push on lip at rear of clip to disengage from bracket.
 b. Rotate tab (stamped ABS) rearward until clip is perpendicular to bracket and remove cable.
3. Remove two brake caliper mounting screws (with cable clip/bracket if ABS equipped). Slide brake caliper straight down to remove from brake disc. Allow the brake caliper to hang loose.

NOTE

Do not operate the brake lever with the front brake caliper removed or the caliper pistons may be forced out. Reseating pistons requires caliper disassembly.

4. Resting motorcycle on jiffy stand, turn front wheel toward left fork stop until front master cylinder reservoir is level. Wrap a clean shop cloth around the outside of the reservoir to protect paint from brake fluid spills.
5. Remove two screws to release cover from master cylinder reservoir.

NOTE

Fluid level will rise as pistons are pushed back into the caliper, possibly overflowing the master cylinder reservoir. Remove some fluid from the reservoir if necessary.

6. Alternately push each pad back until pistons are fully seated in the bores.
7. Pull screen from caliper.
8. See Figure 1-26. Pull retaining clip from groove in pad pin.
9. See Figure 1-23. Remove pad pin (metric).
10. Pull on pad pin side of brake pads to release from caliper.
11. Remove pad spring if damaged or worn.
12. If removed, seat **new** pad spring on flat in caliper, so that clips on spring engage indentations in caliper. Be sure that forked end of pad spring is on the pad pin side of the caliper.

⚠WARNING

Always replace brake pads in complete sets for correct and safe brake operation. Improper brake operation could result in death or serious injury. (00111a)

13. Install **new** brake pads as follows:
 a. See Figure 1-24. Hold inner brake pad, so that pad pin tab is on the same side as pad pin hole in caliper.
 b. See Figure 1-25. Insert opposite side of brake pad into caliper engaging square shaped corner of pad in slot of caliper.
 c. Push pad pin tab side of brake pad into caliper until seated.
 d. Verify that brake pad friction material faces brake disc gap in caliper.
 e. Repeat step to install outer brake pad.
14. Turn caliper over. Verify that pad pin tabs are centered under forks of pad spring. Adjust pads if necessary.
15. Install **new** pad pin and tighten to 75-102 **in-lbs** (8.5-11.5 Nm).
16. See Figure 1-26. Install retaining clip in groove of pad pin, so that lip overhangs caliper housing.

17. Engaging two prongs on screen beneath forked end of pad spring, push on single prong side of screen until engaged.
18. Install brake caliper as follows:
 a. With the bleeder valve topside, install caliper at bottom of brake disc.
 b. Slide brake caliper straight up until holes are aligned with lugs on fork slider. Start two mounting screws (with cable clip/bracket if ABS equipped).

NOTE

Be sure that tab (stamped ABS) on clip is installed in slot of bracket from inboard side. Clip cannot be installed once mounting screws are started.

 c. Alternately tighten mounting screws to 28-38 ft-lbs (37.9-51.5 Nm).

⚠WARNING

After servicing brakes and before moving motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00279a)

19. If ABS equipped, install two **new** cable straps as follows:
 a. Install cable strap 2.5 in. (63.5 mm) above the bottom brake hose crimp capturing front wheel speed sensor cable and brake hose.
 b. Install cable strap 2.5 in. (63.5 mm) below the top brake hose crimp capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.
20. If ABS equipped, install front wheel speed sensor cable in clip as follows:
 a. Rotate tab (stamped ABS) until clip is perpendicular to bracket and install cable.
 b. Rotate tab forward until clip is in-line with bracket and then apply pressure to tab until lip engages. Gently pull on cable to verify that clip is properly installed.
21. Repeat applicable steps to replace brake pads in right side caliper.

⚠WARNING

After servicing brakes and before moving motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00279a)

22. Depress brake lever several times to set brake pads to proper operating position within caliper.
23. See Figure 1-27. Check brake fluid level in master cylinder reservoir. If necessary, add D.O.T. 4 BRAKE FLUID until level is flush with step (marked MAX) cast at rear of reservoir.
24. Install master cylinder reservoir cover. Install cover screws and tighten to 7-10 **in-lbs** (0.8-1.1 Nm).

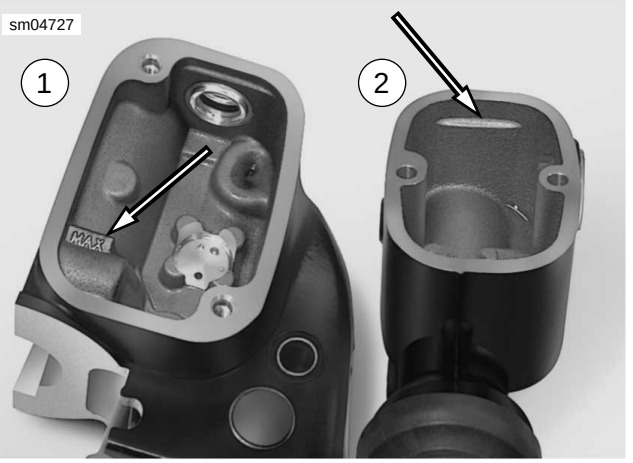
⚠WARNING

After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

25. Test brake system.
 a. Turn ignition switch ON. Depress brake lever to verify operation of brake lamp.
 b. Test ride motorcycle. Bleed system if brakes feel spongy. See 1.16 BLEEDING BRAKES.

NOTE

*Avoid making hard stops for the first 100 miles (160 km). This allows the **new** pads to become conditioned to the brake discs.*



1. **Front master cylinder reservoir**
2. **Rear master cylinder reservoir**

Figure 1-27. Brake Fluid Level

BLEEDING BRAKES 1.16

GENERAL

⚠WARNING

Use denatured alcohol to clean brake system components. Do not use mineral-based solvents (such as gasoline or paint thinner), which will deteriorate rubber parts even after assembly. Deterioration of these components can cause brake failure, which could result in death or serious injury. (00291a)

⚠CAUTION

Direct contact of D.O.T. 4 brake fluid with eyes can cause irritation. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts of D.O.T. 4 brake fluid can cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN. (00240a)

CAUTION

D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)

CAUTION

Do not allow dirt or debris to enter the master cylinder reservoir. Dirt or debris in the reservoir can cause improper operation and equipment damage. (00205c)

Front brake hand lever and rear brake foot pedal must have a firm feel when brakes are applied. If not, bleed system as described.

PROCEDURE

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II
SNAP-ON BB200A	BASIC VACUUM BRAKE BLEEDER

NOTES

- *For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool, particularly if the brake system was completely drained. Refer to the instructions provided with the tool. If a vacuum brake bleeder is not available, use the procedure which follows.*
- *When removing or replacing a bleeder valve in the rear brake caliper or front banjo bleeder bolts, remove the o-ring from the bleeder valve groove or bore and discard. The o-ring is required only for brake bleeding at the factory. Although not sold separately, it may be present in certain assemblies as currently sold. If care is not taken to remove and discard the o-ring, it may become lodged in the caliper/banjo bleeder bolt bore during bleeder valve installation and prevent proper torquing or sealing.*
- *ABS equipped motorcycles require the use of DIGITAL TECHNICIAN II (Part No. HD-48650) to confirm that the brake lines are properly connected and that air is adequately bled from ABS unit.*

1. Remove bleeder valve cap. Install end of a length of clear plastic tubing over caliper bleeder valve. Place free end of tube in a clean container.
2. If bleeding rear brake system, stand motorcycle upright, so that rear master cylinder reservoir is level. If bleeding front brake system, turn front wheel until front master cylinder reservoir is level.

NOTE

Wrap a clean shop cloth around the outside of the master cylinder reservoir to protect paint from brake fluid spills.

3. Remove cover from master cylinder reservoir.
4. See Figure 1-28. Add D.O.T. 4 BRAKE FLUID to master cylinder reservoir as follows:
 a. Front master cylinder reservoir: flush with step (marked MAX) cast at rear of reservoir or 0.20 in. (5.0 mm) from the top.
 b. Rear master cylinder reservoir: flush with ledge cast at front of reservoir or 0.26 in. (6.5 mm) from the top.

⚠WARNING

Any time the ABS module, either master cylinder, or any line between a master cylinder and the ABS module is disconnected or replaced, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to do so could result in air in the hydraulic brake system, reducing brake efficiency, which could result in death or serious injury. (00585b)

5. If vehicle is ABS equipped, connect DIGITAL TECHNICIAN II (Part No. HD-48650).
6. Pump the brake lever/pedal to build up hydraulic pressure.
7. While holding the brake lever/pedal, open brake caliper bleeder valve about 3/4 turn. Close bleeder valve as soon as a loss of hydraulic pressure is detected (or when brake lever/pedal has moved 1/2 to 3/4 of its full range of travel). Allow brake lever/pedal to return slowly to its released position.
8. Repeat steps 4-6 until all air bubbles are purged and a solid column of fluid is observed in the bleeder tube. Pay careful attention to the level of the fluid in the master cylinder reservoir. To avoid drawing air into the brake lines, always add fluid to the master cylinder reservoir before it empties.
9. Tighten bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm). Install bleeder valve cap.

NOTE

If bleeding the front brake system, repeat applicable steps to bleed the line to the second brake caliper.

10. Add brake fluid to the master cylinder reservoir as described in step 4.

⚠WARNING

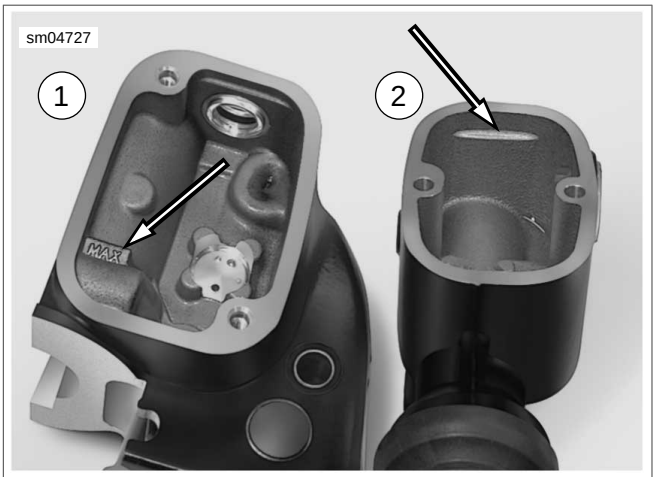
A plugged or covered relief port can cause brake drag or lock-up, which could lead to loss of control, resulting in death or serious injury. (00288a)

11. Verify proper operation of the master cylinder relief port. Actuate the brake hand lever. A slight spurt of fluid will break the fluid surface in the reservoir if all internal components are working properly.
12. Verify that the master cylinder cover gasket bellows is not extended or brake fluid will be ejected from the reservoir. Install cover and tighten screws as follows:
 a. Front master cylinder reservoir: 7-10 **in-lbs** (0.8-1.1 Nm).
 b. Rear master cylinder reservoir: 12-15 **in-lbs** (1.4-1.7 Nm).
13. If motorcycle is ABS equipped, disconnect DIGITAL TECHNICIAN II (Part No. HD-48650).
14. With the Ignition/Light Key Switch turned to IGNITION, alternately apply front and rear brakes to verify operation of the brake lamp.

⚠WARNING

After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

15. Test ride motorcycle. Repeat the bleeding procedure if brakes feel spongy.



1. Front master cylinder reservoir
2. Rear master cylinder reservoir

Figure 1-28. Brake Fluid Level

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

BATTERY MAINTENANCE 1.17

GENERAL

⚠WARNING

Batteries contain sulfuric acid, which could cause severe burns to eyes and skin. Wear a protective face shield, rubberized gloves and protective clothing when working with batteries. KEEP BATTERIES AWAY FROM CHILDREN. (00063a)

⚠WARNING

Never remove warning label attached to top of battery. Failure to read and understand all precautions contained in warning, could result in death or serious injury. (00064a)

⚠WARNING

Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the State of California to cause cancer, and birth defects or other reproductive harm. Wash hands after handling. (00019e)

All AGM batteries are permanently sealed, maintenance-free, valve-regulated, lead/calcium and sulfuric acid batteries. The batteries are shipped pre-charged and ready to be put into service. Do not attempt to open these batteries for any reason.

NOTE

For charging information, see 1.17 BATTERY MAINTENANCE, Charging Battery. For testing information, see ELECTRICAL DIAGNOSTIC MANUAL.

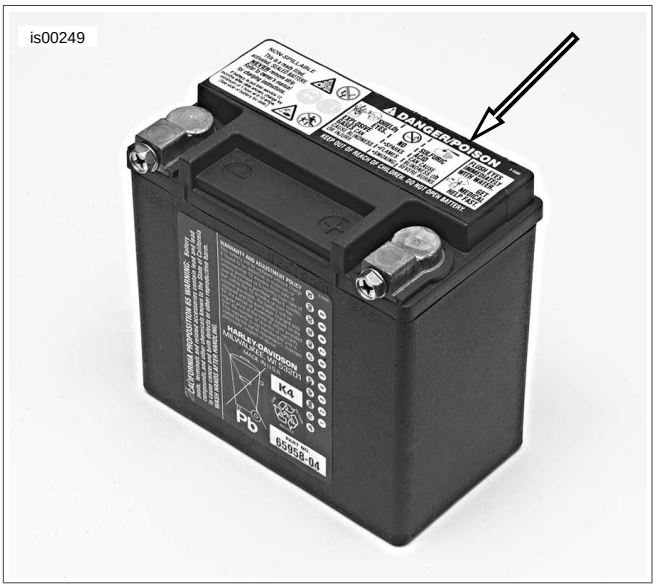
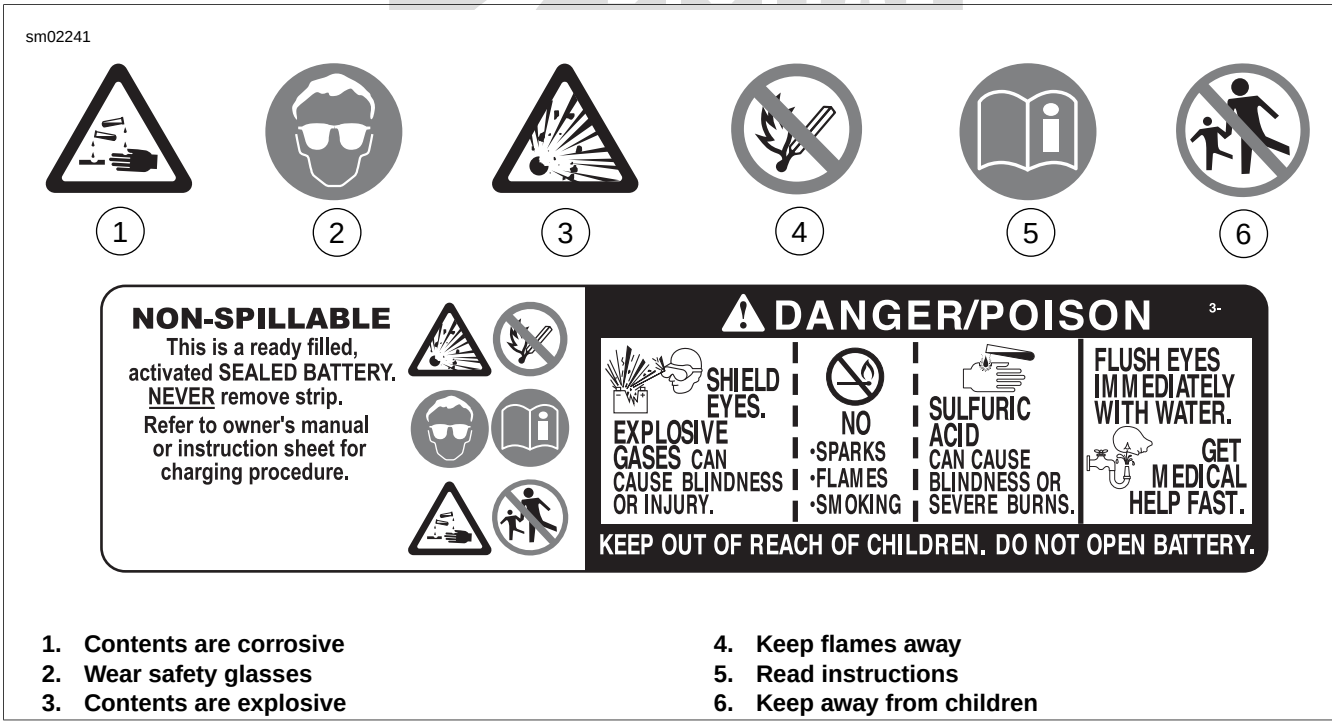


Figure 1-29. AGM Battery with Warning Label



1. **Contents are corrosive**
2. **Wear safety glasses**
3. **Contents are explosive**
4. **Keep flames away**
5. **Read instructions**
6. **Keep away from children**

Figure 1-30. Battery Warning label

Table 1-11. Antidotes for Battery Acid

CONTACT	TREATMENT
External	Flush with water.
Internal	Drink large quantities of milk or water, followed by milk of magnesia, vegetable oil or beaten eggs. Get immediate medical attention.
Eyes	Flush with water. Get immediate medical attention.

CLEANING AND INSPECTION

1. Battery top must be clean and dry. Dirt and electrolyte on top of the battery can cause battery to self-discharge. Clean battery top with a solution of baking soda (sodium bicarbonate) and water (5 teaspoons baking soda per quart or liter of water). When the solution stops bubbling, rinse off the battery with clean water.
2. Clean cable connectors and battery terminals using a wire brush or sandpaper. Remove any oxidation.
3. Inspect the battery screws, clamps and cables for breakage, loose connections and corrosion. Clean clamps.
4. Check the battery posts for melting or damage caused by overtightening.
5. Inspect the battery for discoloration, raised top or a warped or distorted case, which might indicate that the battery has been frozen, overheated or overcharged.
6. Inspect the battery case for cracks or leaks.

BATTERY

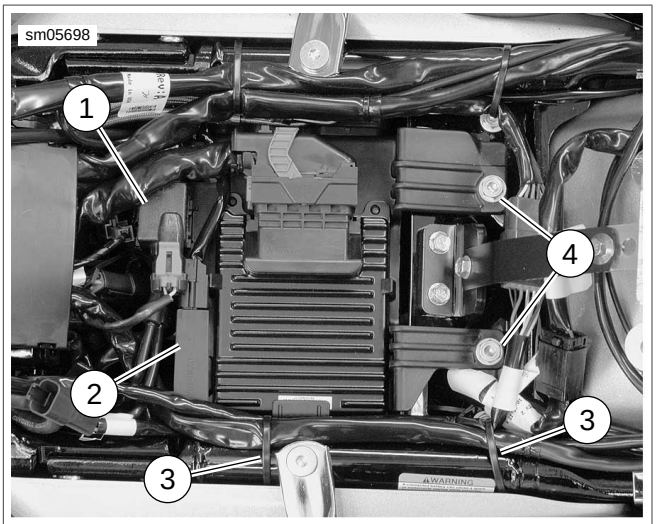
Disconnection and Removal

1. Remove seat.
2. See Figure 1-31. If present, move purge solenoid (1) forward to release from top caddy. Release HFSM antenna (2) from top caddy and move out of the way.
3. Remove fasteners (4).
4. Cut cable ties (3) and move harnesses to allow more clearance for the top caddy.
5. See Figure 1-32. Release top caddy from front hold-down and rotate top caddy (1) out of the way.

⚠WARNING

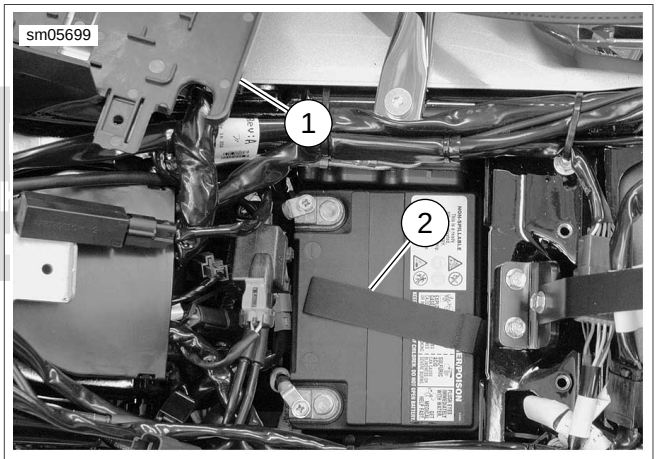
Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)

6. Remove battery negative cable (black) from battery negative (-) terminal.
7. Remove battery positive cable (red) from battery positive (+) terminal.
8. Grasp lifting strap (2) and pull up to raise battery. When battery is extracted far enough to get a good grip, grasp battery and remove the rest of the way.



1. **Purge solenoid**
2. **HFSM antenna**
3. **Cable ties**
4. **Fastener**

Figure 1-31. Top Caddy



1. **Top caddy**
2. **Lifting strap**

Figure 1-32. Move Top Caddy Aside

Installation and Connection

CAUTION

Connect the cables to the correct battery terminals. Failure to do so could result in damage to the motorcycle electrical system. (00215a)

⚠WARNING

Do not allow positive (+) battery cable to contact ground with negative (-) cable connected. Resulting sparks can cause a battery explosion, which could result in death or serious injury. (00069a)

1. Run lifting strap rearward, first down the center of the battery tray, then up and across the frame crossmember.

2. Place the battery into the battery tray, terminal side forward.

⚠WARNING

Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

CAUTION

Do not over-tighten bolts on battery terminals. Use recommended torque values. Over-tightening battery terminal bolts could result in damage to battery terminals. (00216a)

3. Connect battery positive cable (red) to battery positive (+) terminal. Tighten bolt to 60-70 **in-lbs** (6.8-7.9 Nm).
4. Connect battery negative cable (black) to battery negative (-) terminal. Tighten bolt to 60-70 **in-lbs** (6.8-7.9 Nm).

CAUTION

Keep battery clean and lightly coat terminals with petroleum jelly to prevent corrosion. Failure to do so could result in damage to battery terminals. (00217a)

5. Apply a light coat of petroleum jelly or ELECTRICAL CONTACT LUBRICANT, Part No. 99861-02 (1 oz tube), to both battery terminals.
6. See Figure 1-32. Fold lifting strap (2) forward over top of battery.
7. See Figure 1-31. Rotate top caddy into position above battery and engage latch on hold-down bracket.
8. If equipped, engage HFSM antenna (2) and purge solenoid (1) on top caddy. Verify all other connectors and harnesses are routed below the purge solenoid mounting tongue.
9. Fasten top caddy to frame crossmember. Tighten screws (4) to 72-96 **in-lbs** (8.1-10.9 Nm).
10. Secure harnesses to frame with cable ties (3).
11. Install seat.

VOLTMETER TEST

⚠WARNING

Batteries contain sulfuric acid, which could cause severe burns to eyes and skin. Wear a protective face shield, rubberized gloves and protective clothing when working with batteries. KEEP BATTERIES AWAY FROM CHILDREN. (00063a)

⚠WARNING

Never remove warning label attached to top of battery. Failure to read and understand all precautions contained in warning, could result in death or serious injury. (00064a)

Voltmeter Test

Refer to Table 1-12. The voltmeter test provides a general indicator of battery condition. Check the voltage of the battery to verify that it is in a 100% fully charged condition. If the open circuit (disconnected) voltage reading is below 12.6V, charge the battery and then recheck the voltage after the battery has set for one to two hours. If the voltage reading is 12.7V or above, perform a load test. See the ELECTRICAL DIAGNOSTIC MANUAL for the load test procedure.

Table 1-12. Voltmeter Test For Battery Charge Conditions

VOLTAGE (OCV)	STATE OF CHARGE
12.7 V	100%
12.6 V	75%
12.3 V	50%
12.0 V	25%
11.8 V	0%

CHARGING BATTERY

Safety Precautions

Never charge a battery without first reviewing the instructions for the charger being used. In addition to the manufacturer's instructions, follow these general safety precautions:

- Always wear eye, face and hand protection.
- Always charge batteries in a well-ventilated area.
- Turn the charger off before connecting the leads to the battery to avoid dangerous sparks.
- Never try to charge a visibly damaged or frozen battery.
- Connect the charger leads to the battery; red positive (+) lead to the positive (+) terminal and black negative (-) lead to the negative (-) terminal. If the battery is still in the vehicle, connect the negative lead to the chassis ground. Be sure that the ignition and all electrical accessories are turned off.
- Make sure that the charger leads to the battery are not separated, frayed or loose.
- If the battery gets hotter than 110° F (43° C) during charging, discontinue charger and allow the battery to cool.
- Always turn the charger off before removing charger leads from the battery to avoid dangerous sparks.

Using a Battery Charger

Charge the battery if any of the following conditions exist:

- Vehicle lights appear dim.
- Electric starter sounds weak.
- Battery has not been used for an extended period of time.

⚠WARNING

Explosive hydrogen gas, which escapes during charging, could cause death or serious injury. Charge battery in a well-ventilated area. Keep open flames, electrical sparks and smoking materials away from battery at all times. KEEP BATTERIES AWAY FROM CHILDREN. (00065a)

CAUTION

If battery releases an excessive amount of gas during charging, decrease the charging rate. Overheating can result in plate distortion, internal shorting, drying out or damage. (00413b)

1. Perform a voltmeter test to determine the state of charge. See the ELECTRICAL DIAGNOSTIC MANUAL. If battery needs to be charged, proceed to the next step.

NOTE

The figures listed in the table assume that the battery is charging at room temperature. If warmer than room temperature, use a slightly shorter charging time. If colder, use a slightly longer charging time.

Table 1-13. 28 Amp-Hour Battery Charging Rate/Times

READING (VOLTS)	PERCENT OF CHARGE	3 AMP CHARGER	6 AMP CHARGER	10 AMP CHARGER	20 AMP CHARGER
12.7	100	-	-	-	-
12.6	75	2.5 hours	1.25 hours	45 minutes	25 minutes
12.3	50	5 hours	2.5 hours	1.5 hours	50 minutes
12.0	25	7.5 hours	3.75 hours	2.25 hours	70 minutes
11.8	0	10 hours	5 hours	3 hours	1.5 hours

NOTE

*The use of constant current chargers to charge sealed maintenance-free batteries is not recommended. Any overcharge will cause dry-out and premature battery failure. If a constant current charger is the only type available, do **not** exceed the charge times listed above and do **not** continue charging the battery if it gets hot. When charging, never exceed 15 volts for more than 30 minutes.*

⚠WARNING

Unplug or turn OFF battery charger before connecting charger cables to battery. Connecting cables with charger ON can cause a spark and battery explosion, which could result in death or serious injury. (00066a)

CAUTION

Do not reverse the charger connections described in the following steps or the charging system of the motorcycle could be damaged. (00214a)

2. Connect red battery charger lead to the positive (+) terminal of the battery.
3. Connect black battery charger lead to the negative (-) terminal of the battery.

NOTE

If the battery is still in the vehicle, connect the negative lead to the chassis ground. Be sure that the ignition and all electrical accessories are turned off.

4. Step away from the battery and turn on the charger. See the charging instructions in Table 1-13.

⚠WARNING

Unplug or turn OFF battery charger before disconnecting charger cables from battery. Disconnecting clamps with charger ON can cause a spark and battery explosion, which could result in death or serious injury. (00067a)

5. After the battery is fully charged, disconnect the black battery charger lead to the negative (-) terminal of the battery.
6. Disconnect the red battery charger lead to the positive (+) terminal of the battery.
7. Mark the charging date on the battery.
8. Perform either a conductance test or load test to determine the condition of the battery. See the ELECTRICAL DIAGNOSTIC MANUAL.
9. If charging battery because voltmeter test reading was below 12.6 V, perform voltmeter test. See the ELECTRICAL DIAGNOSTIC MANUAL.

STORAGE

PART NUMBER	TOOL NAME
99863-01A	GLOBAL BATTERY CHARGER

⚠WARNING

Batteries contain sulfuric acid, which could cause severe burns to eyes and skin. Wear a protective face shield, rubberized gloves and protective clothing when working with batteries. KEEP BATTERIES AWAY FROM CHILDREN. (00063a)

CAUTION

Do not allow battery to completely discharge. The electrolyte in a discharged battery will freeze. The more discharged a battery is, the more easily it can freeze and crack the battery case. (00218a)

If the motorcycle is to be stored with the security system armed, connect a GLOBAL BATTERY CHARGER (Part No. 99863-01A) to maintain battery charge.

If the motorcycle is to be stored with the battery installed, a GLOBAL BATTERY CHARGER unavailable, and with the security system **not** armed, unplug the main fuse.

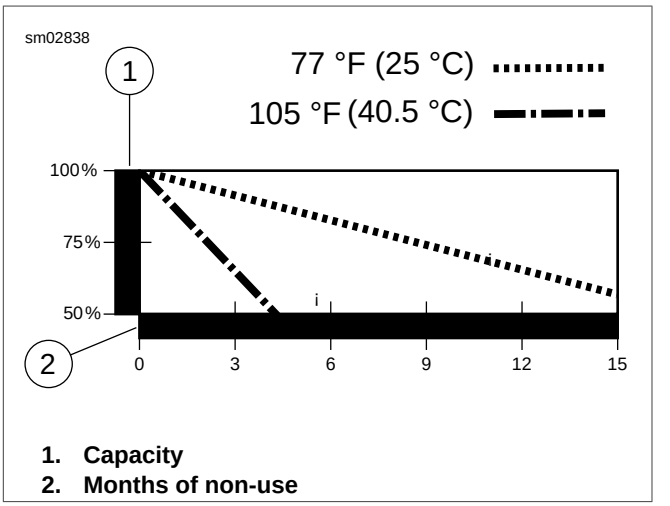
If the motorcycle will not be operated for several months, such as during the winter season, remove the battery from the motorcycle and fully charge.

See Figure 1-33. Self-discharge is a normal condition and occurs continuously at a rate that depends on the ambient temperature and the battery's state of charge. Batteries discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool (not freezing), dry place.

Charge the battery every month if stored at temperatures below 60° F (16° C). Charge the battery more frequently if stored in a warm area above 60° F (16° C).

NOTES

- *The GLOBAL BATTERY CHARGER (Part No. 99863-01A) may be used to maintain battery charge for extended periods of time without risk of overcharging or boiling.*
- *When returning a battery to service after storage, see ELECTRICAL DIAGNOSTIC MANUAL.*



1. **Capacity**
2. **Months of non-use**

Figure 1-33. Battery Self-Discharge Rate

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

SUSPENSION ADJUSTMENTS 1.18

GENERAL

PART NUMBER	TOOL NAME
HD-34633A	AIR SUSPENSION PUMP AND GAUGE

Adjust the rear air suspension pressure by adding or removing air from the air valve located near the upper shock absorber mount on the left side of the motorcycle. See Figure 1-34. Always adjust pressures with the motorcycle on the jiffy stand.

Air pressure may be varied to suit load conditions, riding style and personal comfort. Less initial pressure does not necessarily result in a softer ride. Refer to the tables below for the recommended air suspension pressures.

WARNING

Do not exceed the motorcycle's Gross Vehicle Weight Rating (GVWR) or Gross Axle Weight Rating (GAWR). Exceeding these weight ratings can affect stability and handling, which could result in death or serious injury. (00016e)

Use Table 1-14 or Table 1-15 as a starting point in determining suitable rear air suspension pressures. Do not exceed maximum GVWR when loading vehicle and do not pressurize system in excess of 50 psi (345 kPa) for FLHX models and 35 psi (241 kPa) for all others.

CAUTION

Do not exceed maximum air pressure for rear suspension. Air components fill rapidly. Therefore, use low air line pressure. Failure to do so may result in possible damage to components. (00165a)

NOTES

- *Use AIR SUSPENSION PUMP AND GAUGE (Part No. HD-34633A) ito adjust suspension air pressure.*
- *Use a no-loss air gauge to check air pressure. Check pressure in shocks weekly if in daily use or before each trip if only used occasionally.*
- *Improper inflation of rear air suspension components also can result in a reduction of available suspension travel, reduced rider comfort and possible damage to shock absorbers.*

WARNING

Use caution when bleeding air from the suspension. Moisture combined with lubricant may leak onto the rear wheel, tire and/or brake components and adversely affect traction, which could result in death or serious injury. (00084a)

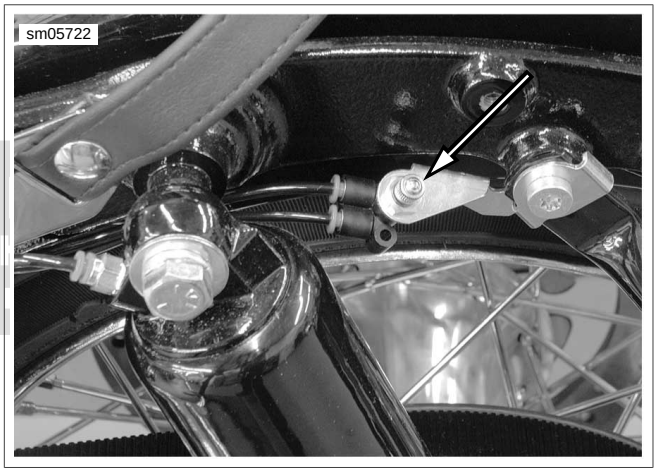


Figure 1-34. Rear Air Suspension Air Valve

Table 1-14. Rear Suspension Recommended Air Pressure: FLHR/C, FLTR, FLHX

SHOCK LOAD	TOTAL WEIGHT		PRESSURE	
	LB.	KG	PSI	kPa
Solo rider	up to 150	up to 68	0	0
	150-200	68-91	0-10	0-69
	200-250	91-113	10-20	69-138
	250-300	113-136	20-30	138-206
	over 300	over 136	30-50	206-345
Solo rider with capacity luggage of 40 lbs (18 kg)	up to 150	up to 68	10-20	69-138
	150-200	68-91	20-30	138-206
	200-250	91-113	30-40	206-276
	250-300	113-136	40-50	276-345
	over 300	over 136	50	345
Rider plus passenger	ALL	ALL	40-50	276-345

Table 1-14. Rear Suspension Recommended Air Pressure: FLHR/C, FLTR, FLHX

SHOCK LOAD	TOTAL WEIGHT		PRESSURE	
	LB.	KG	PSI	kPa
Maximum GVWR	ALL	ALL	50	345
If P&A Tour-Pak is installed, add 5-10 psi (34-69 kPa) to shock pressure. Do **not** exceed 50 psi (345 kPa) rear shock pressure.				

Table 1-15. Rear Suspension Recommended Air Pressure: FLHT/C/U

SHOCK LOAD	TOTAL WEIGHT		PRESSURE	
	LB.	KG	PSI	kPa
Solo rider	up to 150	up to 68	5-10	34-69
	150-200	68-91	10-20	69-138
	200-250	91-113	20-30	138-206
	250-300	113-136	30-40	206-276
	over 300	over 136	40-50	276-345
Solo rider with capacity luggage of 70 lbs (32 kg)	up to 150	up to 68	25-30	172-206
	150-200	68-91	30-40	206-276
	200-250	91-113	40-50	276-345
	over 250	over 113	50	345
Rider plus passenger	ALL	ALL	50	345
Maximum GVWR	ALL	ALL	50	345
Do **not** exceed 50 psi (345 kPa) rear shock pressure.				

DIGITAL TECHNICIAN II HARLEY-DAVIDSON®

FRONT FORK OIL 1.19

REPLACING FORK OIL

Fork assemblies must be removed to drain fork oil. See 2.19 FRONT FORK.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

SPARK PLUGS 1.20

INSPECTION

WARNING

Disconnecting spark plug cable with engine running can result in electric shock and death or serious injury. (00464b)

1. After the engine has cooled to room temperature, disconnect cables from both spark plugs.
2. Remove spark plugs. If a plug has eroded electrodes, heavy deposits or a cracked insulator, discard it.
3. See Figure 1-35. Compare your observations of the plug deposits with the descriptions provided below.
 a. A wet, black and shiny deposit on plug base, electrodes and ceramic insulator tip indicates an oil fouled plug. The condition may be caused by one or more of the following: worn pistons, worn piston rings, worn valves, worn valve guides, worn valve seals, a weak battery or a faulty ignition system.
 b. A dry, fluffy or sooty black deposit indicates an air-fuel mixture that is too rich.
 c. A light brown, glassy deposit indicates an overheated plug. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes and is caused by an air-fuel mixture that is too lean, a hot-running engine, valves not seating or improper ignition timing. The glassy deposit on the spark plug is a conductor when hot and may cause high-speed misfiring. A plug with eroded electrodes, heavy deposits or a cracked insulator must be replaced.
 d. A plug with a white, yellow, tan or rusty brown powdery deposit indicates balanced combustion. Clean off spark plug deposits at regular intervals.

WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

4. If the plugs require cleaning between tune-ups, proceed as follows:
 a. Degrease firing end of spark plug using ELECTRICAL CONTACT CLEANER. Dry plug with compressed air.
 b. Use a thin file to flatten spark plug electrodes. A spark plug with sharp edges on its electrodes requires 25-40% less firing voltage than one with rounded edges.
 c. If the plugs cannot be cleaned, replace with **new** spark plugs.
5. Check electrode gap with a wire-type feeler gauge. Bend the outside of the electrode so only a slight drag on the gauge is felt when passing it between electrodes. Proper gap measurement is 0.038-0.043 in. (0.97-1.09 mm).
6. Check condition of threads on cylinder head and plug. If necessary to remove deposits, apply penetrating oil and clean out with a thread chaser.
7. Apply LOCTITE ANTI-SEIZE to the spark plug threads. Install and tighten to 12-18 ft-lbs (16.3-24.4 Nm).
8. Connect spark plug cables. Rear cylinder plug cable attaches to right coil terminal. Verify that cables are securely connected to coil and spark plugs.

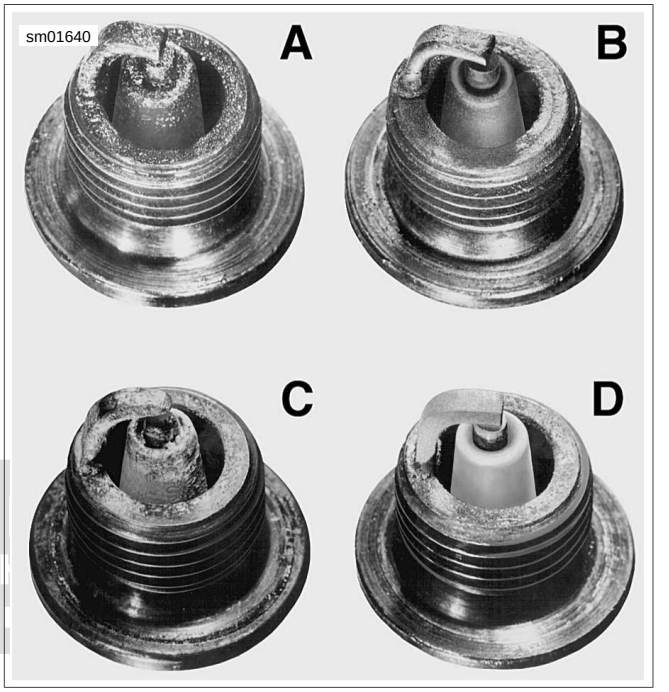


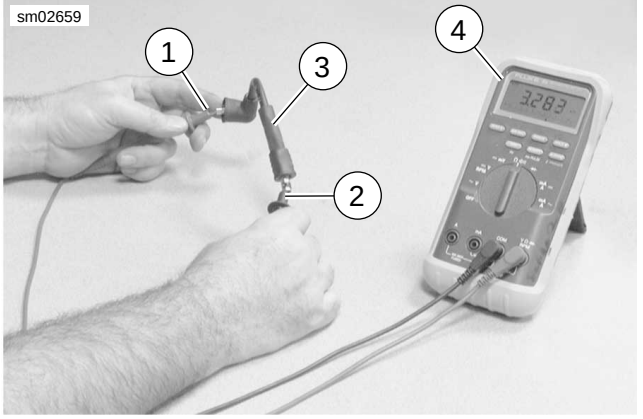
Figure 1-35. Typical Spark Plug Deposits

SPARK PLUG CABLE INSPECTION

1. Inspect spark plug cables. Replace cables that are worn or damaged.
 a. Check for cracks or loose terminals.
 b. Check for loose fit on ignition coil and spark plugs.
2. Check cable boots/caps for cracks or tears. Replace boots/caps that are worn or damaged.
3. See Figure 1-36. Check spark plug cable resistance with an ohmmeter. Compare values from test with Table 1-16. Replace cables not meeting resistance specifications.

Table 1-16. Spark Plug Cable Resistance Values

DESCRIPTION	LENGTH		RESISTANCE VALUE (OHMS)
	In.	mm	
Front cable	34.75	883	8688-23,178
Rear cable	16.75	425	4188-11,172



1. **Ohmmeter positive lead**
2. **Ohmmeter negative lead**
3. **Spark plug cable**
4. **Ohmmeter**

Figure 1-36. Testing Resistance

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

STEERING HEAD BEARINGS 1.21

LUBRICATION

1. See Figure 1-37.Turn handlebar to the right fork stop to access grease fitting at the left side of the steering head.
2. Inject Special Purpose Grease, Part No. 99857-97 until it exudes from top and bottom of steering head.



Figure 1-37. Steering Head Bearing Grease Fitting

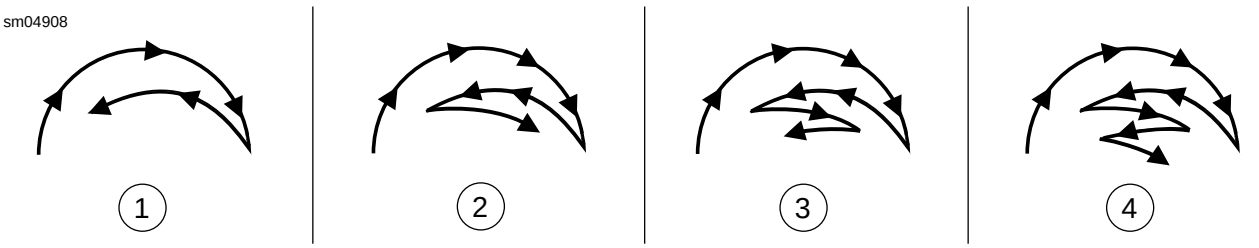
CHECKING

1. Raise the motorcycle so that the front and rear tires are the same distance from the floor.
2. Verify that motorcycle is in stock configuration. Remove all non-factory accessories, since they can influence front end swing momentum (and lead to improper adjustment).
3. See Figure 1-38. Turn the front wheel until contact is made with the left fork stop and then let go. The wheel should swing from side to side, finally stopping in either the third or fourth swing. If it stops in the third swing, it should be at or after the center or straight-forward position.
4. If the clutch cable or main harness appears to be influencing swing momentum, proceed as follows and repeat the previous step:
 a. **Clutch cable:** Disconnect clutch cable at hand lever. Release cable from P-clamp fastened to upper fork bracket (FLHR/C), remove from inner fairing (FLHT/C/U), or release from cable clip on instrument nacelle (FLTR). See 2.25 CLUTCH CABLE if necessary.
 b. **Main harness:** Remove rivet and P-clamp to release main harness from steering head. Secure P-clamp with a **new** rivet when procedure is complete.

NOTE

A steering head that is too tight can interfere with the vehicle's ability to absorb a weave. A steering head that is too loose can interfere with the vehicle's ability to absorb a wobble.

5. To correct a swing pattern that is too short or too long, see 1.21 STEERING HEAD BEARINGS, Adjustment.

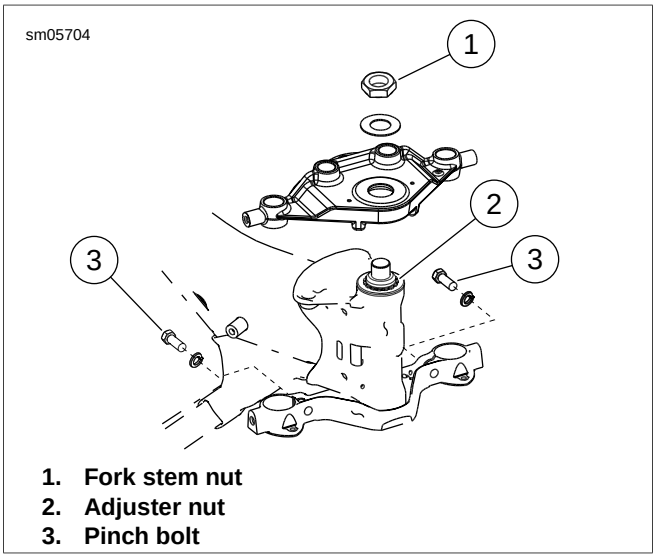


1. **Too tight- wheel stops in first or second swing**
2. **Correct- wheel stops in third swing**
3. **Correct- wheel stops in fourth swing**
4. **Too loose- wheel stops in fifth swing**

Figure 1-38. Check Steering Head Bearing Swing-by

ADJUSTMENT

1. Disassemble motorcycle as follows:
 a. **FLHR/C:** Remove headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
 b. **FLHX, FLHT/C/U:** Remove outer fairing and radio (storage box on FLHT). See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 7.33 ADVANCED AUDIO SYSTEM, respectively.
 c. **FLTR:** Remove instrument bezel. See 2.42 INSTRUMENT BEZEL: FLTR.
2. See Figure 1-39. Loosen pinch bolts (3) on lower fork bracket to prevent any binding of the front end when the adjustment is made.



1. **Fork stem nut**
2. **Adjuster nut**
3. **Pinch bolt**

Figure 1-39. Fork Stem and Brackets

3. Loosen the fork stem nut (1).
4. See Figure 1-40. Fashion a bearing adjuster tool using a drill rod 1/4 in. (6.4 mm) in diameter and 16 in. (406.4 mm) long.

NOTE

See Figure 1-39. Turning the bearing adjuster nut (2) as little as one notch will make a noticeable difference in the swing pattern.

5. Turn bearing adjuster nut (2) as follows:
 a. To decrease the number of swings, rotate nut **clockwise**.
 b. To increase the number of swings, rotate nut **counterclockwise**.

NOTES

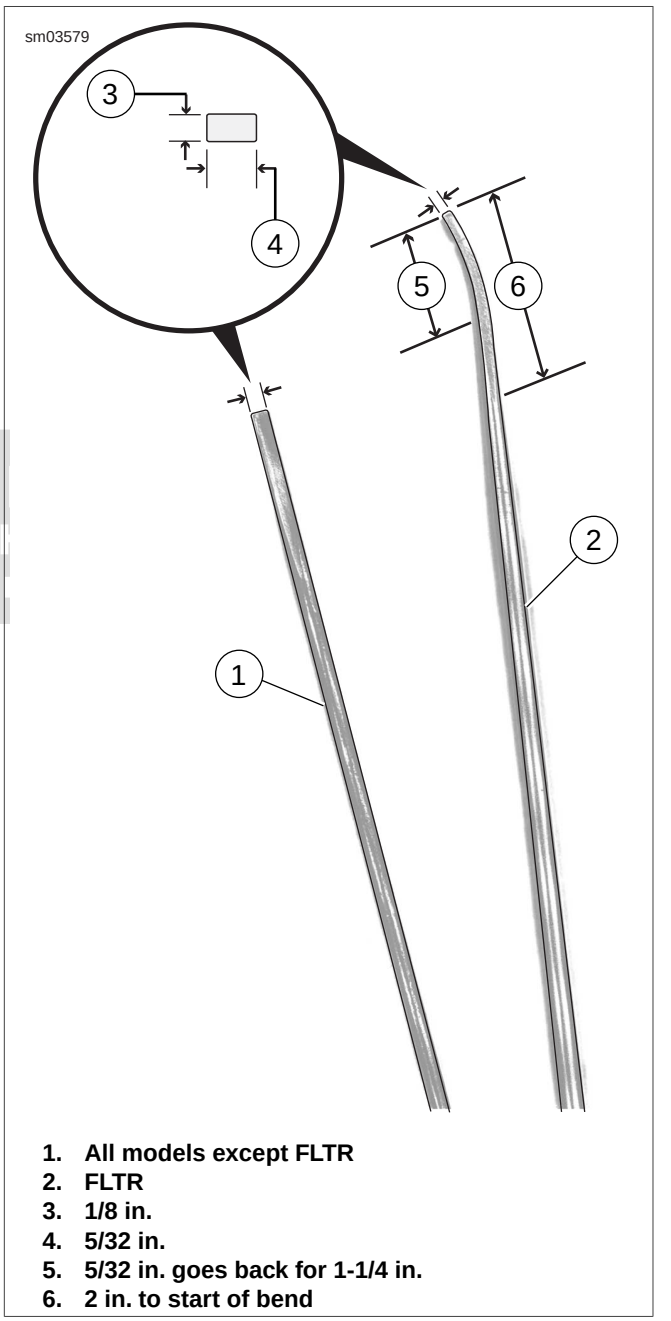
- *Original equipment fork stem nut has a blue dye coating. If a replacement nut is being installed, the replacement nut will not have the blue coating.*
- *Whenever the stem nut is loosened or removed, the threads must be lubricated with anti-seize lubricant prior to assembly and tightening.*

6. Remove the stem nut and lubricate threads with a light coating of anti-seize lubricant.
7. Install stem nut and tighten to 70-80 ft-lbs (94.9-108.4 Nm).

NOTE

The tightness of the nut will affect the swing pattern.

8. Recheck the swing pattern and adjust as necessary.
9. Tighten pinch bolts to 53-57 ft-lbs (71.9-77.3 Nm).
10. Verify that the fork stem nut is tightened to 70-80 ft-lbs (94.9-108.4 Nm).
11. Recheck the swing pattern and adjust if necessary.
12. Assemble motorcycle as follows:
 a. **FLHR/C:** Install headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
 b. **FLHX, FLHT/C/U:** Install radio (storage box on FLHT) and outer fairing. See 7.33 ADVANCED AUDIO SYSTEM and 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, respectively.
 c. **FLTR:** Install instrument bezel. See 2.42 INSTRUMENT BEZEL: FLTR.
13. Install any accessories that were removed during the checking procedure.



1. **All models except FLTR**
2. **FLTR**
3. **1/8 in.**
4. **5/32 in.**
5. **5/32 in. goes back for 1-1/4 in.**
6. **2 in. to start of bend**

Figure 1-40. Fashion Bearing Adjuster Tool

CABLE AND CHASSIS LUBRICATION 1.22

GENERAL

Inspect and lubricate the following at scheduled service intervals as specified in 1.3 MAINTENANCE SCHEDULE.

- Front brake hand lever.
- Clutch hand lever.
- Clutch cable.
- Foot shift lever pivot (if applicable).
- Rear brake lever pivot.
- Steering head bearings.
- Jiffy stand.

If service is on muddy or dusty roads, clean and lubricate at shorter intervals.

Use SUPER OIL (Part no. HD-94968-85TV) for hand levers and cables.

STEERING HEAD BEARINGS

Lubricate the steering head bearings with HARLEY-DAVIDSON SPECIAL PURPOSE GREASE. See 1.21 STEERING HEAD BEARINGS for procedure.

JIFFY STAND

Clean and lubricate the jiffy stand. For more information, see 2.53 JIFFY STAND.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

HEADLAMP ALIGNMENT 1.23

HEADLAMP ALIGNMENT

⚠WARNING

The automatic-on headlamp feature provides increased visibility of the rider to other motorists. Be sure headlamp is on at all times. Poor visibility of rider to other motorists can result in death or serious injury. (00030b)

NOTE

Vehicles with multiple beam headlamps that are individually aimed should be adjusted so both lamps converge into one pattern.

1. Verify that front and rear tire inflation pressures are correct and that suspension is adjusted to the weight of the principal rider. See 1.10 TIRES AND WHEELS.
2. Fill fuel tank or add ballast to equal the weight of the fuel needed.

NOTE

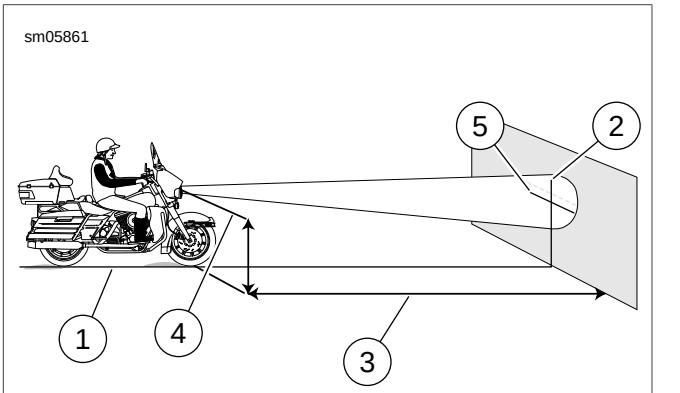
See Figure 1-41. To aid in properly placing the motorcycle, a perpendicular line (1) can be drawn on the floor. For best results, choose an area with minimum light.

3. See Figure 1-41. Draw a vertical line (2) on the wall.
4. Position motorcycle so that front axle is 25 feet (7.6 meters) from wall.

NOTE

As the weight of the rider will compress the suspension slightly, have a person whose weight is approximately the same as that of the principal rider sit on the motorcycle.

5. With the vehicle laden and upright, point the front wheel straight forward at wall and measure the distance (4) from the floor to the center of the HIGH BEAM bulb.
6. Draw a horizontal line (5) through the vertical line on the wall that is 2.1 in. (53.3 mm) lower than the measured bulb centerline.



1. **Perpendicular line**
2. **Vertical line**
3. **25 feet (7.6 meters)**
4. **High beam bulb centerline**
5. **Horizontal line 2.1 in. (53.3 mm) lower than bulb centerline**

Figure 1-41. Check Headlamp Alignment

NOTE

As the weight of the rider will compress the suspension slightly, have a person whose weight is approximately the same as that of the principal rider sit on the motorcycle.

7. See Figure 1-41. Verify headlamp alignment. Turn the ignition switch to IGNITION and set the headlamp switch to HIGH beam.
 a. The center of the hot spot (brightest area of light beam) should be centered where the two lines intersect.
 b. Adjust headlamp alignment if necessary.

MAIN HEADLAMP ADJUSTMENT

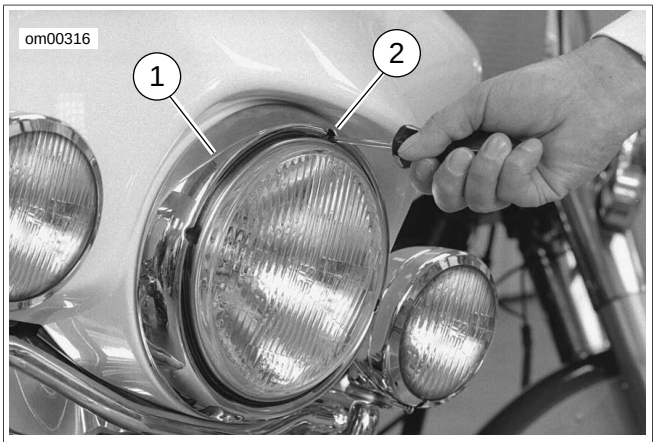
Adjust FLHR/FLHT Headlamp

NOTE

Headlamp adjustment can be performed without removing the headlamp door (chrome ring).

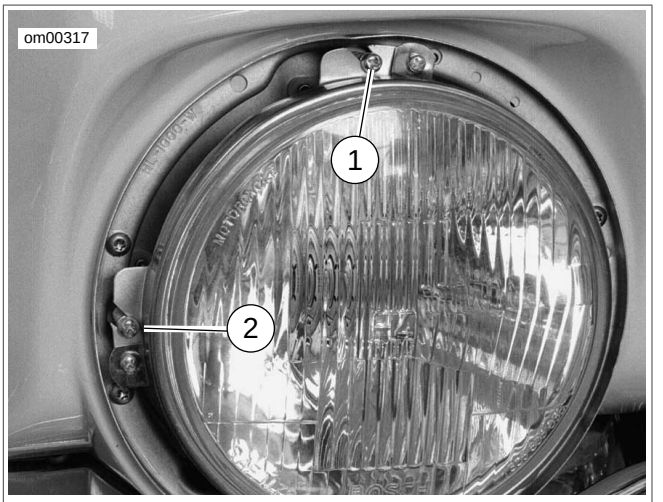
1. See Figure 1-42. Using adjuster slots in headlamp door, insert Phillips screwdriver between headlamp housing and rubber gasket.
2. See Figure 1-43. Adjust beam.
 a. **Horizontal:** Turn the horizontal adjusting screw to adjust headlamp horizontally.
 b. **Vertical:** Turn the vertical adjusting screw to adjust headlamp vertically.

DIGITAL TECHNICIAN HARLEY-DAVIDSON®



1. **Headlamp door**
2. **Slot**

Figure 1-42. Headlamp Door



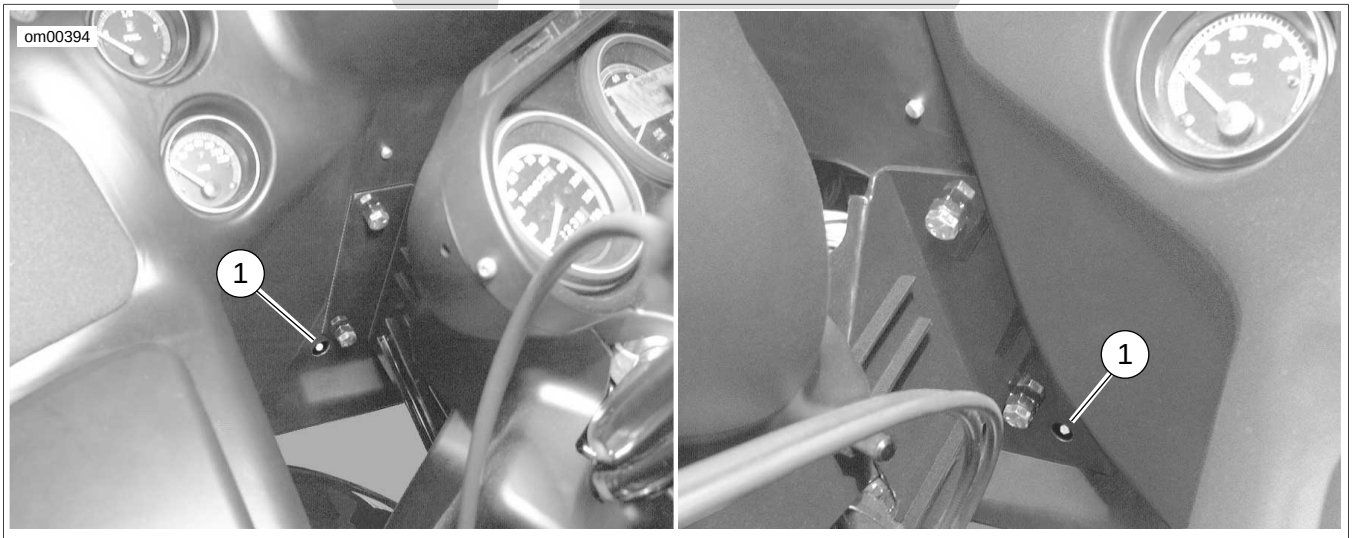
1. **Vertical adjusting screw**
2. **Horizontal adjusting screw**

Figure 1-43. Adjust Headlamp Alignment: FLHR/FLHT

Adjust FLTR Headlamps

1. See Figure 1-44. Using a 4.5 mm deepwell socket with a flexible driver, rotate hex adjusters located near bottom edge of inner fairing.
2. Adjust beam.
 a. **Horizontal:** Turn either the left or right adjuster to adjust headlamp horizontally.
 b. **Vertical:** Turn both adjusters equally to adjust headlamp vertically. Refer to Table 1-17 for directions to move headlamp beam.

DIGITAL TECHNICIAN HARLEY-DAVIDSON



1. **Hex adjuster**

Figure 1-44. Headlamp Adjustment: FLTR

Table 1-17. FLTR Hex Adjuster Rotation

Hex Adjuster	Rotation	Beam Movement
Left Only	CW	To the right
Right Only	CCW	
Left Only	CCW	To the left
Right Only	CW	
Left and Right Equally	CW	Upward
Left and Right Equally	CCW	Downward
CW = Clockwise CCW = Counter-clockwise		

AUXILIARY LAMP ALIGNMENT

NOTE

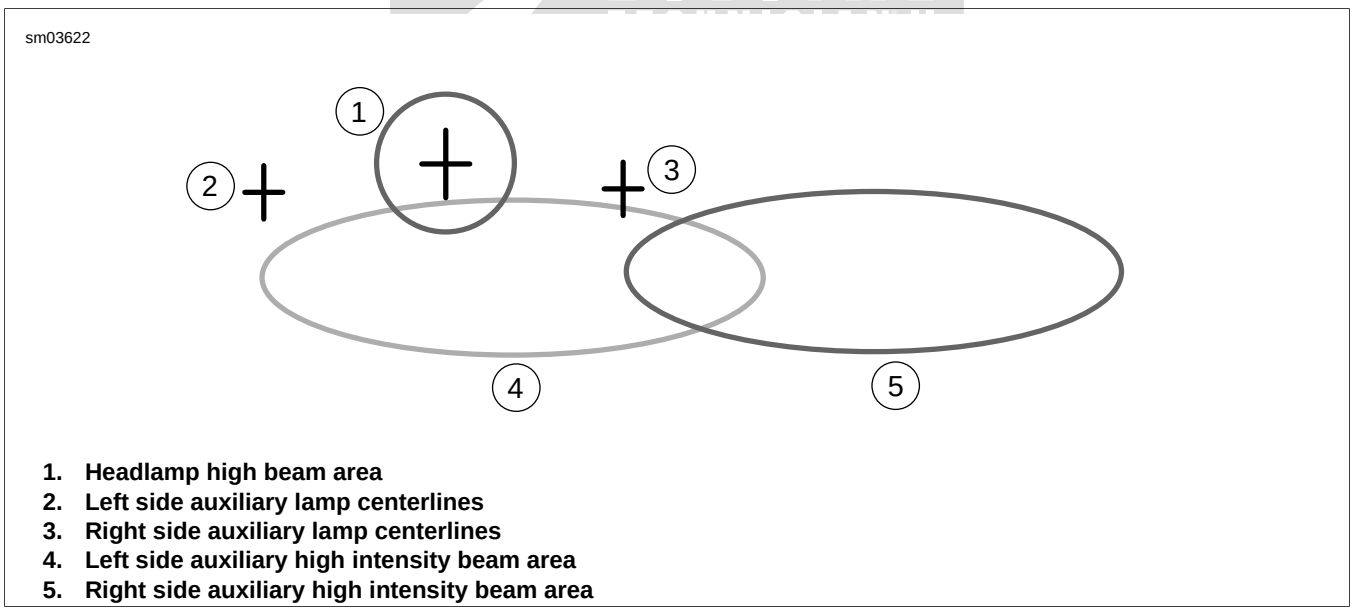
See Figure 1-45. In countries where travel is on the left side of the road, shift the auxiliary lamp high intensity patterns (4, 5) to the left.

1. Place the vehicle facing a target wall as described in 1.23 HEADLAMP ALIGNMENT, Headlamp Alignment.

NOTE

As the weight of the rider will compress the suspension slightly, have a person whose weight is roughly the same as that of the principal rider sit on the motorcycle.

2. With a rider seated on the motorcycle, measure the distance from the floor to the centerline of each auxiliary lamp.
3. Measure the distance from the headlamp vertical centerline to the vertical centerline of each auxiliary lamp.
4. See Figure 1-45. Mark the auxiliary lamp horizontal and vertical centerlines (2, 3) on the wall.
5. Remove two screws to release turn signal lamp from mounting bracket.
6. Obtain flare nut socket (Snap-on® FRX181). Loosen the auxiliary lamp flange nut only enough to allow movement of the lamp.
7. Turn on the headlamp low beam and cover both the headlamp and the right side auxiliary lamp. Adjust the left side auxiliary lamp as necessary so that the entire high intensity zone (4) is below and to the right of the left side auxiliary lamp centerlines as shown in Figure 1-45.
8. Cover the headlamp and left side auxiliary lamp. Adjust the right side auxiliary lamp as necessary so that the entire high intensity zone (5) is both below and to the right of the right side auxiliary lamp centerlines as shown in Figure 1-45.
9. Tighten auxiliary lamp flange nut to 15-18 ft-lbs (20.3-24.4 Nm).
10. Start two screws to secure turn signal lamp to mounting bracket. Verify that conduit fits in slot at back of bracket and is not pinched. Tighten screws to 36-60 **in-lbs** (4.1-6.8 Nm).



1. **Headlamp high beam area**
2. **Left side auxiliary lamp centerlines**
3. **Right side auxiliary lamp centerlines**
4. **Left side auxiliary high intensity beam area**
5. **Right side auxiliary high intensity beam area**

Figure 1-45. Properly Aim Auxiliary Lamps

ENGINE MOUNTS 1.24

INSPECTION

General

Inspect the condition and tightness of the stabilizer links and engine mounts. Replace fasteners if damaged.

Top Link

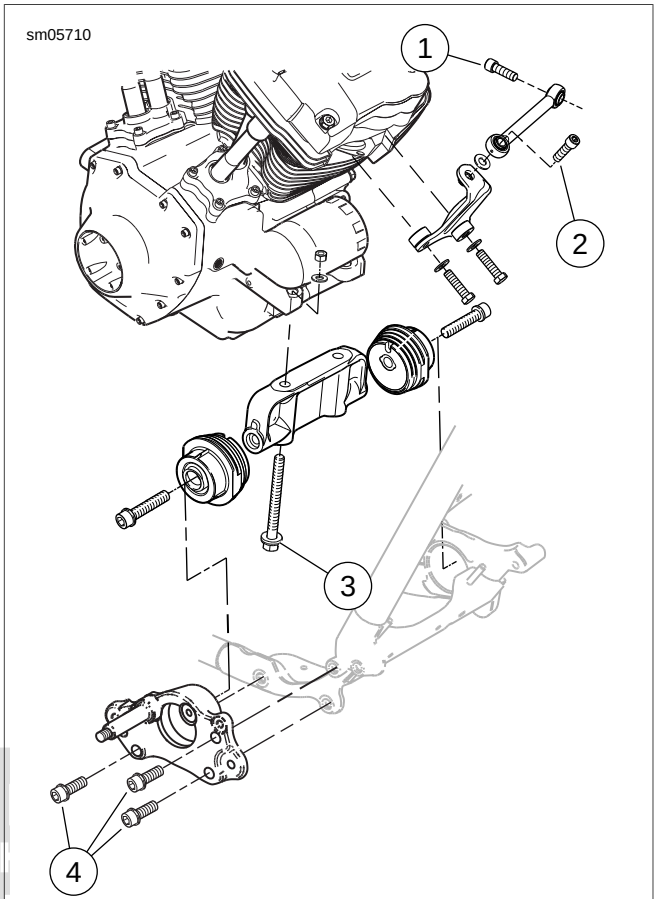
1. See Figure 1-46. Check top stabilizer link eyelet to frame weldment bolt (1): 18-22 ft-lbs (24.4-29.9 Nm).
2. Check top stabilizer link eyelet to top engine mounting bracket bolt (2): 18-22 ft-lbs (24.4-29.9 Nm).

Front Engine Mount

1. See Figure 1-46. Check two engine to front engine mounting bracket bolts (3): 36-40 ft-lbs (49-54 Nm).
2. Check three front engine mount end cap bolts (4): 42-48 ft-lbs (56.9-65.0 Nm).

Rear Frame Fasteners

See Figure 1-47. Check three fasteners on each side that attach the rear frame to the main frame. The correct torque is 40-50 ft-lbs (54.2-67.8 Nm).



1. **Link-to-frame weldment fastener**
2. **Link-to-engine mounting bracket fastener**
3. **Engine mount fastener (2)**
4. **Engine mount end cap fastener**

Figure 1-46. Front Mount and Stabilizer

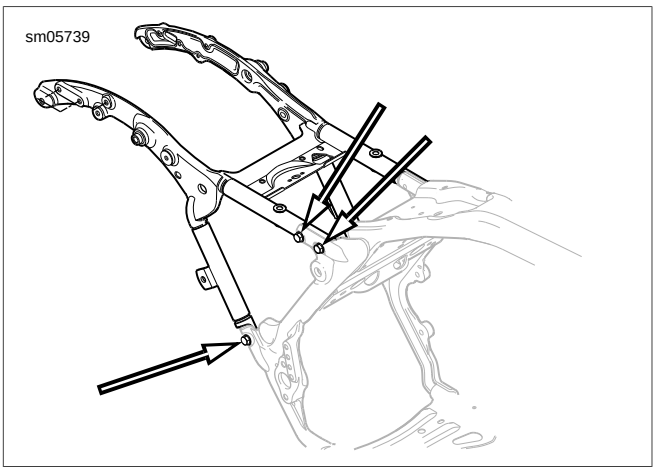


Figure 1-47. Rear Frame Fasteners

STORAGE 1.25

GENERAL

If the motorcycle will not be operated for several months, such as during the winter season, there are several things which should be done to protect parts against corrosion, to preserve the battery and to prevent the buildup of gum and varnish in the fuel system.

This work should be performed following Service Manual procedures.

PLACING IN STORAGE

PART NUMBER	TOOL NAME
98716-87A	STORAGE COVER

⚠WARNING

Do not store motorcycle with gasoline in tank within the home or garage where open flames, pilot lights, sparks or electric motors are present. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00003a)

⚠WARNING

Avoid spills. Slowly remove filler cap. Do not fill above bottom of filler neck insert, leaving air space for fuel expansion. Secure filler cap after refueling. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00028a)

⚠WARNING

Use care when refueling. Pressurized air in fuel tank can force gasoline to escape through filler tube. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00029a)

1. Prepare the fuel system by filling fuel tank and adding a gasoline stabilizer. Use one of the commercially available gasoline stabilizers following the manufacturer's instructions.
2. Run motorcycle until engine is at normal operating temperature. Stop the engine then drain the oil pan, install a **new** oil filter, and fill oil pan with the proper grade oil. Check the transmission lubricant level.
3. Remove the spark plugs, inject a few squirts of engine oil into each cylinder and crank the engine 5-6 revolutions. Install spark plugs.
4. Inspect rear belt deflection. See 1.13 REAR BELT DEFLECTION.
5. Inspect rear belt and sprockets. See 1.12 REAR BELT AND SPROCKETS.
6. Inspect air cleaner filter. See 1.9 AIR CLEANER AND EXHAUST SYSTEM.
7. Lubricate controls. See 1.22 CABLE AND CHASSIS LUBRICATION.
8. Inspect operation of all electrical equipment and switches.
9. Check tire inflation and inspect tires for wear and/or damage. See 1.10 TIRES AND WHEELS. If the motorcycle will be stored for an extended period of time, securely support the motorcycle under the frame so that all weight is off the tires.
10. Wash painted and chrome-plated surfaces. Apply a light film of oil to exposed unpainted surfaces.

⚠WARNING

Unplug or turn OFF battery charger before connecting charger cables to battery. Connecting cables with charger ON can cause a spark and battery explosion, which could result in death or serious injury. (00066a)

⚠WARNING

Explosive hydrogen gas, which escapes during charging, could cause death or serious injury. Charge battery in a well-ventilated area. Keep open flames, electrical sparks and smoking materials away from battery at all times. KEEP BATTERIES AWAY FROM CHILDREN. (00065a)

11. Remove battery from vehicle. Charge battery until the correct voltage is obtained. Charge the battery every other month if it is stored at temperatures below 60° F (16° C). Charge battery once a month if it is stored at temperatures above 60° F (16° C). See 1.17 BATTERY MAINTENANCE.

⚠WARNING

Unplug or turn OFF battery charger before disconnecting charger cables from battery. Disconnecting clamps with charger ON can cause a spark and battery explosion, which could result in death or serious injury. (00067a)

12. If the motorcycle is to be covered, use a material that will breathe, such as STORAGE COVER (Part No. 98716-87A) or light canvas. Plastic materials that do not breathe promote the formation of condensation, which leads to corrosion.

REMOVAL FROM STORAGE

⚠WARNING

The clutch failing to disengage can cause loss of control, which could result in death or serious injury. Prior to starting after extended periods of storage, place transmission in gear and push vehicle back and forth several times to assure proper clutch disengagement. (00075a)

1. Charge and install the battery.
2. Remove and inspect the spark plugs. Replace if necessary.
3. Clean the air cleaner element.
4. If fuel tank was drained, fill fuel tank with fresh gasoline.

5. Start the engine and run until it reaches normal operating temperature.
6. Check engine oil level. Check the transmission lubricant level. Fill to proper levels with correct fluids, if required.
7. Perform all of the checks in the PRE-RIDING CHECKLIST in the Owner's Manual.

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TROUBLESHOOTING 1.26

GENERAL

⚠WARNING

The Troubleshooting section of this manual is a guide to diagnose problems. Read the appropriate sections of this manual before performing any work. Improper repair and/or maintenance could result in death or serious injury. (00528b)

The following check list of possible operating troubles and their probable causes will be helpful in keeping a motorcycle in good operating condition. More than one of these conditions may be causing the trouble and all should be carefully checked.

NOTE

For further troubleshooting information, see the ELECTRICAL DIAGNOSTIC MANUAL.

ENGINE

Starter Motor Does Not Operate or Does Not Turn Engine Over

1. Ignition switch not in IGNITION position.
2. Engine run switch in OFF position.
3. Discharged battery, loose or corroded connections (solenoid chatters).
4. Starter control circuit, relay, or solenoid faulty.
5. Electric starter shaft pinion gear not engaging or overrunning clutch slipping.
6. TSM/TSSM/HFSM Bank Angle Sensor tripped and ignition/light key switch not cycled OFF then back to IGNITION.
7. Security system activated.
8. Motorcycle in gear and clutch not pulled in.
9. Jiffy stand down and transmission in gear (HDI models only).
10. Main fuse not in place.

Engine Turns Over But Does Not Start

1. Fuel tank empty.
2. Fouled spark plugs.
3. Discharged battery, loose or damaged battery terminal connections.
4. Engine lubricant too heavy (winter operation).

NOTE

For cold weather starts, always disengage clutch.

5. Spark plug cables in bad condition and shorting, cable connections loose or cables connected to incorrect cylinders.
6. Damaged wire or loose wire connection at ignition coil, battery, or ECM connector.
7. Ignition timing incorrect due to faulty ignition coil, ECM or sensors.
8. Bank Angle Sensor tripped and ignition switch not cycled OFF then back to IGNITION.
9. Fuel filter clogged.
10. Sticking or damaged valve(s) or wrong length push rod(s).
11. Plugged fuel injectors.

Starts Hard

1. Spark plugs in bad condition or have improper gap or are partially fouled.
2. Spark plug cables in poor condition.
3. Battery nearly discharged.
4. Damaged wire or loose wire connection at one of the battery terminals, ignition coil or ECM connector.
5. Water or dirt in fuel system.
6. Intake air leak.
7. Fuel tank vent hose, filler cap vent or vapor valve plugged, or fuel line closed off, restricting fuel flow.
8. Engine lubricant too heavy (winter operation).

NOTE

For cold weather starts, always disengage clutch.

9. Ignition not functioning properly (possible sensor failure).
10. Faulty ignition coil.
11. Valves sticking.
12. Partially plugged fuel injector(s).

Starts But Runs Irregularly or Misses

1. Spark plugs in poor condition or partially fouled.
2. Spark plug cables in poor condition and shorting or leaking.
3. Spark plug gap too close or too wide.
4. Faulty ignition coil, ECM, or sensor.
5. Battery nearly discharged.
6. Damaged wire or loose connection at battery terminals, ignition coil or ECM connector.
7. Intermittent short circuit due to damaged wire insulation.
8. Water or dirt in fuel system.
9. Fuel tank vent system plugged.
10. Air leak at intake manifold or air cleaner.
11. Loose or dirty ECM connector.
12. Faulty Sensor(s): Temperature Manifold Absolute Pressure (TMAP), Crank Position (CKP) or Oxygen (O2).
13. Incorrect valve timing.
14. Weak or damaged valve springs.

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15. Damaged intake or exhaust valve.
16. Partially plugged fuel injector(s).

A Spark Plug Fouls Repeatedly

1. Fuel mixture too rich.
2. Incorrect spark plug for the kind of service.
3. Piston rings badly worn or damaged.
4. Valve guides or seals badly worn.

Pre-Ignition or Detonation (Knocks or Pings)

1. Fuel octane rating too low.
2. Faulty spark plugs.
3. Incorrect spark plug for the kind of service.
4. Excessive carbon deposit on piston head or in combustion chamber.
5. Ignition timing advanced due to faulty sensor inputs (TMAP and/or CKP).
6. Ignition timing advanced due to ECM or sensors (CKP, ET or TMAP) defective.
7. Intake manifold vacuum leak.

Overheating

1. Insufficient oil supply or oil not circulating.
2. Insufficient air flow over engine.
3. Heavy carbon deposits.
4. Ignition timing retarded due to defective ECM or faulty sensor(s) (TMAP and/or CKP).
5. Leaking valve(s).

Valve Train Noise

1. Low oil pressure caused by oil feed pump not functioning properly or oil passages obstructed.
2. Faulty hydraulic lifter(s).
3. Bent push rod(s).
4. Incorrect push rod length.
5. Rocker arm binding on shaft.
6. Valve sticking in guide.
7. Chain tensioning spring or shoe worn.
8. Cam(s), cam gear(s) or cam bushing(s) worn.
9. Cam timing incorrect.

Excessive Vibration

1. Wheels bent or damaged and/or tires worn or damaged.
2. Engine/Transmission/Rear Wheel not aligned properly.
3. Primary chain badly worn or links tight as a result of insufficient lubrication or misalignment.
4. Engine to transmission mounting bolts loose.
5. Upper engine mounting bracket loose/damaged or mounting bracket pre-loaded.
6. Ignition timing advanced due to faulty sensor inputs (TMAP and/or CKP)/poorly tuned engine.
7. Internal engine problem.
8. Damaged frame.
9. Stabilizer links worn or loose, or stabilizer link brackets loose or damaged.
10. Isolators worn or isolator bolts loose or damaged.
11. Rubber mounts loose or worn.
12. Rear fork pivot shaft fasteners loose.
13. Front engine mounting bolts loose.

Check Engine Light Illuminates During Operation

1. Fault detected. See the ELECTRICAL DIAGNOSTIC MANUAL for more information.

LUBRICATION SYSTEM

Oil Does Not Return To Oil Reservoir

1. Oil reservoir empty.
2. Oil pump not functioning.
3. Restricted oil lines or fittings.
4. Restricted oil filter.
5. O-ring damaged or missing from oil pump/crankcase junction (also results in poor engine performance).

Engine Uses Too Much Oil Or Smokes Excessively

1. Oil reservoir overfilled.
2. Restricted oil return line to oil reservoir.
3. Restricted breather operation.
4. Restricted oil filter.
5. Oil pump misaligned or in poor condition.
6. Piston rings badly worn or broken.
7. Valve guides or seals worn or damaged.
8. O-ring damaged or missing from oil pump/crankcase junction (also results in poor engine performance).
9. Plugged crankcase scavenge port.
10. Oil diluted with gasoline.

Engine Leaks Oil From Cases, Push Rods, Hoses, Etc.

1. Loose parts.
2. Imperfect seal at gaskets, push rod covers, washers, etc.
3. Restricted breather passages or hose to air cleaner.
4. Restricted oil filter.
5. Oil reservoir overfilled.

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6. Lower rocker housing gasket installed incorrectly (upside down).
7. Restricted oil return line to oil reservoir.
8. Porosity.

Low Oil Pressure

1. Oil reservoir underfilled.
2. Faulty low oil pressure switch.
3. Oil pump o-ring damaged or missing.
4. Bypass valve stuck in open position.
5. Ball missing or leaking in cam support plate.
6. Worn oil pump gerotor(s).
7. Oil diluted with gasoline.

High Oil Pressure

1. Oil reservoir overfilled.
2. Bypass valve stuck in closed position.

ELECTRICAL SYSTEM

NOTE

For diagnostic information see the ELECTRICAL DIAGNOSTIC MANUAL.

Alternator Does Not Charge

1. Voltage regulator module not grounded.
2. Engine ground wire loose or broken.
3. Faulty voltage regulator module.
4. Loose or broken wires in charging circuit.
5. Faulty stator and/or rotor.

Alternator Charge Rate Is Below Normal

1. Weak or damaged battery.
2. Loose connections.
3. Faulty voltage regulator module.
4. Faulty stator and/or rotor.

Speedometer Operates Erratically

1. Contaminated vehicle speed sensor (remove sensor and clean off metal particles).
2. Loose connections.

TRANSMISSION

Shifts Hard

1. Primary chaincase overfilled with lubricant.
2. Clutch not fully disengaging.
3. Transmission lubricant too heavy (winter operation).
4. Shifter return spring (inside transmission) bent or broken.
5. Bent shifter rod.
6. Shifter forks (inside transmission) sprung.
7. Corners worn off shifter clutch dog rings (inside transmission).

Jumps Out Of Gear

1. Shifter rod improperly adjusted.
2. Shifter drum (inside transmission) improperly adjusted or damaged/worn.
3. Shifter engaging parts (inside transmission) badly worn and rounded.
4. Shifter forks bent.
5. Damaged gears.

Clutch Slips

1. Clutch controls improperly adjusted.
2. Insufficient clutch spring tension.
3. Worn friction discs.

Clutch Drags Or Does Not Release

1. Lubricant level too high in primary chaincase.
2. Clutch controls improperly adjusted.
3. Primary chain badly misaligned or too tight.
4. Insufficient clutch spring tension.
5. Clutch discs warped.

Clutch Chatters

Friction discs or steel discs worn or warped.

HANDLING

Irregularities

1. Improperly loaded motorcycle. Non-standard equipment on the front end such as heavy radio receivers, extra lighting equipment or luggage tends to cause unstable handling.
2. Damaged tire(s) or improper front-rear tire combination.
3. Irregular or peaked front tire tread wear.
4. Incorrect tire pressure.
5. Shock absorber not functioning normally.
6. Incorrect air suspension pressure.
7. Loose wheel axle nuts. Tighten to recommended torque specification.
8. Excessive wheel hub bearing play.
9. Rear wheel out of alignment with frame and front wheel.
10. Steering head bearings improperly adjusted. Correct adjustment and replace pitted or worn bearings and races.
11. Loose spokes (laced wheel vehicles only).
12. Tire and wheel unbalanced.
13. Rims and tires out-of-round or eccentric with hub.
14. Rims and tires out-of-true sideways.

15. Rear fork pivot assembly: improperly tightened or assembled, or loose/pitted or damaged pivot bearings.
16. Engine mounts and/or stabilizer links loose, worn or damaged..

BRAKES

Brake Does Not Hold Normally

1. Master cylinder reservoir low on fluid, system leaking or pads worn.
2. Brake system contains air bubbles.
3. Master cylinder or caliper piston seals worn or parts damaged.
4. Brake pads contaminated with grease or oil.
5. Brake pads badly worn.
6. Brake disc badly worn or warped.
7. Brake drags - insufficient brake pedal or hand lever free-play, caliper piston worn or damaged, or excessive brake fluid in reservoir.
8. Brake fades due to heat build up - brake pads dragging or excessive braking.
9. Brake fluid leak when under pressure.

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CRITICAL FASTENERS 1.27

INSPECTION

Inspect critical fasteners at the scheduled service intervals.

Replace any fasteners that are damaged or missing.

Checking Torques on Fasteners

Refer to Table 1-18. Attempt to turn the fastener using a torque wrench set to the minimum torque specification for that fastener. If the fastener does not rotate, the fastener torque has been maintained. If the fastener rotates, remove it to determine if it has a locking agent.

If it has a locking agent, clean all locking material from the threaded hole. Replace the fastener with a new one or clean the original fastener threads and apply the appropriate locking agent (see appropriate procedure). Install and tighten the fastener to specification.

If the fastener does not have a locking agent, install and tighten to specification.

Table 1-18. Critical Fasteners

SYSTEM	FASTENER	TORQUE	
Hand controls	Switch housing screws	35-45 **in-lbs**	4-5 Nm
	Clutch lever bracket handlebar clamp screws	72-108 **in-lbs**	8-12 Nm
	Master cylinder reservoir handlebar clamp screws	72-84 **in-lbs**	8.1-9.5 Nm
Brakes	Brake caliper banjo bolts	17-19 ft-lbs	23-26 Nm
	Master cylinder banjo bolts	12.5-14.5 ft-lbs	17.0-19.7 Nm
	ABS module banjo bolts	12.5-14.5 ft-lbs	17.0-19.7 Nm
	Front brake disc screws	16-24 ft-lbs	22-33 Nm
	Rear brake disc screws	30-45 ft-lbs	41-61 Nm
	Front master cylinder reservoir cover screws	7-10 **in-lbs**	0.8-1.1 Nm
	Rear master cylinder reservoir cover screws	12-15 **in-lbs**	1.4-1.7 Nm
	Rear master cylinder to frame screws	126-150 **in-lbs**	14-17 Nm
	Front brake caliper mounting screws	28-38 ft-lbs	38-52 Nm
	Rear brake caliper to caliper bracket screws	43-48 ft-lbs	58-65 Nm
	Brake caliper pad pin	75-102 **in-lbs**	8.5-11.5 Nm
Axle nuts	Front	60-65 ft-lbs	81-88 Nm
	Rear	95-105 ft-lbs	129-142 Nm
Front forks	Front axle holder nuts	132-180 **in-lbs**	15-20 Nm
Pivot shaft	Locknuts	55-65 ft-lbs	74.6-88.1 Nm
	Rear fork bracket bolts	55-65 ft-lbs	74.6-88.1 Nm
Other	Transmission to engine bolts	34-39 ft-lbs	46-53 Nm
	Engine mount bolts	See 1.24 ENGINE MOUNTS.	
	Rear frame bolts	40-50 ft-lbs	54.2-67.8 Nm

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NOTES

FASTENER TORQUE VALUES 2.1

FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

FASTENER	TORQUE VALUE		NOTES
2 inch diameter gauge nuts	10-20 **in-lbs**	1.1-2.3 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
Air baffle hex screws (FLTR)	120-144 **in-lbs**	13.6-16.3 Nm	2.20 AIR BAFFLE: FLTR, Air Baffle (FLTR)
Air baffle hex screws (FLTR)	120-144 **in-lbs**	13.6-16.3 Nm	2.20 AIR BAFFLE: FLTR, Air Baffle (FLTR)
Air baffle screws (FLTR)	120-144 **in-lbs**	13.6-16.3 Nm	2.21 STEERING HEAD BEARINGS, Installation
Air deflector bolts	25-35 **in-lbs**	2.8-4.0 Nm	2.40 AIR DEFLECTORS, Mid-Frame Air Deflectors
Air deflector screws	25-30 **in-lbs**	2.8-3.4 Nm	2.40 AIR DEFLECTORS, Air Deflectors (FLHTCU)
Air valve mount hex nut	40-50 **in-lbs**	4.5-5.6 Nm	2.22 REAR AIR SUSPENSION, Check for Air Leaks
Auxiliary lamp bracket to fork bracket screws	15-20 ft-lbs	20-27 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
Banjo bleeder bolt to caliper	17-19 ft-lbs	23.1-25.8 Nm	2.15 FRONT BRAKE CALIPER, Installation
Banjo bleeder bolt to front brake caliper	17-19 ft-lbs	23.1-25.8 Nm	2.14 FRONT BRAKE MASTER CYLINDER, Front Brake Line - Non-ABS Equipped
Banjo bolt to caliper	17-19 ft-lbs	23.1-25.8 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped
Banjo bolt to caliper	17-19 ft-lbs	23.1-25.8 Nm	2.17 REAR BRAKE CALIPER, Installation
Banjo bolt to master cylinder	13-15 ft-lbs	17.6-20.3 Nm	2.14 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Banjo bolt to master cylinder	13-15 ft-lbs	17.6-20.3 Nm	2.16 REAR BRAKE MASTER CYLINDER, Assembly and Installation
Banjo bolt to master cylinder	12.5-14.5 ft-lbs	16.9-19.7 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped
Banjo bolt to master cylinder reservoir	12.5-14.5 ft-lbs	17.0-19.7 Nm	2.14 FRONT BRAKE MASTER CYLINDER, Front Brake Line - Non-ABS Equipped
Battery tray screws	72-96 **in-lbs**	8.1-10.8 Nm	2.51 REAR FRAME, Rear Frame
Brake caliper (front) mounting screws	28-38 ft-lbs	37.9-51.5 Nm	2.15 FRONT BRAKE CALIPER, Installation/metric
Brake caliper (rear) socket head screws	43-48 ft-lbs	58.3-65.1 Nm	2.5 REAR WHEEL, Installation/metric
Brake caliper (rear) to caliper bracket screws	43-48 ft-lbs	58.3-65.1 Nm	2.17 REAR BRAKE CALIPER, Installation/metric
Brake disc (front) screws	16-24 ft-lbs	22-33 Nm	2.4 FRONT WHEEL, Installation/Always use new screws
Brake disc (rear) screws	30-45 ft-lbs	41-61 Nm	2.5 REAR WHEEL, Installation/Always use new screws
Brake light switch bracket fastener	80-100 **in-lbs**	9.0-11.3 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped
Brake line bracket to lower fork bracket screw	120-180 **in-lbs**	13.6-20.3 Nm	2.21 STEERING HEAD BEARINGS, Installation
Brake pedal shaft locknut	15-20 ft-lbs	20-27 Nm	2.16 REAR BRAKE MASTER CYLINDER, Assembly and Installation
Brake pedal shaft locknut	15-20 ft-lbs	20-27 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped
Clutch cable fitting	90-120 **in-lbs**	10.2-13.6 Nm	2.25 CLUTCH CABLE, Installation

FASTENER	TORQUE VALUE		NOTES
Clutch lever bracket handlebar clamp screws	72-108 **in-lbs**	8-12 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
Engine guard T40 TORX screws	15-20 ft-lbs	20.3-27.1 Nm	2.36 LOWER FAIRING AND ENGINE GUARD, Engine Guard
Engine mount bracket fasteners	36-40 ft-lbs	48.8-54.2 Nm	2.54 FRONT ENGINE MOUNT, Installation
Engine mount end cap fasteners	42-48 ft-lbs	56.9-65.0 Nm	2.54 FRONT ENGINE MOUNT, Installation
Fairing bracket/steering head thru bolt locknuts (FLTR)	20-30 ft-lbs	27.1-40.7 Nm	2.44 INNER FAIRING: FLTR, Installation
Fairing cap screws	25-30 **in-lbs**	2.8-3.4 Nm	2.38 FAIRING CAP: FLHX, FLHT/C/U, Fairing Cap
Fairing speaker lower screw (FLHX, FLHTC/U)	22-28 **in-lbs**	2.5-3.2 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
Fairing speaker upper screws (FLHX, FLHTC/U)	35-50 **in-lbs**	4.0-5.7 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
Fork bracket pinch bolt	53-57 ft-lbs	71.9-77.3 Nm	2.19 FRONT FORK, Installation
Fork cap bolt	60-70 ft-lbs	81.4-94.9 Nm	2.19 FRONT FORK, Installation
Fork damper tube screw (6mm)	132-216 **in-lbs**	14.9-24.4 Nm	2.19 FRONT FORK, Assembly
Fork oil drain plug	72-96 **in-lbs**	8-11 Nm	2.19 FRONT FORK, Changing Fork Oil
Fork stem nut	70-80 ft-lbs	95-109 Nm	2.21 STEERING HEAD BEARINGS, Installation
Fork tube plug	60-70 ft-lbs	81.4-94.9 Nm	2.19 FRONT FORK, Changing Fork Oil
Frame cover fastener, rear	15-20 ft lbs	20.3-27.1 Nm	2.31 TOUR-PAK, Luggage Rack/Tour-Pak Support
Frame cover fastener, rear	15-20 ft-lbs	20-27 Nm	2.49 REAR FENDER, Installation
Front axle holder nuts	132-180 **in-lbs**	14.9-20.3 Nm	2.4 FRONT WHEEL, Installation/metric
Front axle nut	60-65 ft-lbs	81.4-88.1 Nm	2.4 FRONT WHEEL, Installation/metric
Front brake line bracket screw	120-180 **in-lbs**	13.6-20.3 Nm	2.14 FRONT BRAKE MASTER CYLINDER, Front Brake Line - Non-ABS Equipped
Front engine mount fasteners	40-50 ft-lbs	54.2-67.8 Nm	2.54 FRONT ENGINE MOUNT, Installation
Front fender mount screws	16-20 ft-lbs	22-27 Nm	2.48 FRONT FENDER, Installation
Front turn signal lamp bracket stud acorn nuts (FLTR)	40-50 **in-lbs**	4.5-5.7 Nm	2.41 UPPER FAIRING AND WINDSHIELD: FLTR, Outer Fairing
Guard to frame screws	32-36 ft-lbs	43.4-48.8 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Handlebar clamp to clutch lever bracket screws	72-108 **in-lbs**	8-12 Nm	2.26 HANDLEBARS, Adjustment
Handlebar clamp to clutch lever bracket T27 TORX screws	60-80 **in-lbs**	6.8-9.0 Nm	2.25 CLUTCH CABLE, Installation
Handlebar clamp to master cylinder reservoir screws	72-80 **in-lbs**	8-9 Nm	2.26 HANDLEBARS, Adjustment
Handlebar lower clamp bolts (risers)	30-40 ft-lbs	40.7-54.2 Nm	2.26 HANDLEBARS, Rubber Mounts
Handlebar upper clamp screws	16-20 ft-lbs	21.7-27.1 Nm	2.26 HANDLEBARS, Adjustment
Handlebar upper clamp screws	16-20 ft-lbs	21.7-27.1 Nm	2.26 HANDLEBARS, Installation
Handlebar upper clamp screws	16-20 ft-lbs	21.7-27.1 Nm	2.26 HANDLEBARS, Installation
Headlamp door screw	9-18 **in-lbs**	1.0-2.0 Nm	2.48 FRONT FENDER, Installation
Headlamp housing Phillips screws	9-18 **in-lbs**	1.0-2.0 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation
Headlamp housing Phillips screws	9-18 **in-lbs**	1.0-2.0 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation
Headlamp housing screws (FLHR/C/S)	9-18 **in-lbs**	1.0-2.0 Nm	2.48 FRONT FENDER, Installation
Headlamp nacelle handlebar chrome strip flange nut	15-20 **in-lbs**	1.7-2.3 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation

FASTENER	TORQUE VALUE		NOTES
Headlamp nacelle handlebar clamp shroud Phillips screws	10-20 **in-lbs**	1.1-2.3 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation
Headlamp nacelle handlebar clamp shroud Phillips screws	10-20 **in-lbs**	1.1-2.3 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation
Headlamp nacelle to fork bracket stud acorn nuts	72-108 **in-lbs**	8.1-12.2 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation
Instrument bezel screws (FLTR)	25-35 **in-lbs**	2.8-4.0 Nm	2.42 INSTRUMENT BEZEL: FLTR, Bezel
Instrument nacelle to fork bracket screws (FLTR)	15-20 ft-lbs	20-27 Nm	2.43 INSTRUMENT NACELLE: FLTR, Instrument Nacelle
Instrument nacelle to fork bracket screws (FLTR)	15-20 ft-lbs	20-27 Nm	2.43 INSTRUMENT NACELLE: FLTR, Instrument Nacelle
Jiffy stand bracket fasteners	36-42 ft-lbs	48.8-57.0 Nm	2.53 JIFFY STAND, Jiffy Stand Bracket
Jiffy stand interlock sensor fastener	96-120 **in-lbs**	10.8-13.6 Nm	2.53 JIFFY STAND, Jiffy Stand Interlock Sensor/Use Loctite Medium Strength Threadlocker 243 (blue) if reusing screw
Jiffy stand leg stop hex screw	15-20 ft-lbs	20.3-27.1 Nm	2.53 JIFFY STAND, Installation
Left electrical caddy fastener	72-96 **in-lbs**	8.1-10.8 Nm	2.51 REAR FRAME, Rear Frame
Lower fairing clip stud flange nuts	35-40 **in-lbs**	4.0-4.5 Nm	2.36 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU)
Lower fairing glove box tray T20 TORX screws	20-25 **in-lbs**	2.3-2.8 Nm	2.36 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU)
Lower fairing glove box tray T20 TORX screws	20-25 **in-lbs**	2.3-2.8 Nm	2.36 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU)
Lower fairing to engine guard clamp T40 TORX screws	90-100 **in-lbs**	10.2-11.3 Nm	2.36 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU)
Luggage rack fastener	15-20 ft lbs	20.3-27.1 Nm	2.31 TOUR-PAK, Luggage Rack/Tour-Pak Support
Luggage rack screws	15-20 ft-lbs	20-27 Nm	2.49 REAR FENDER, Installation
Master cylinder reservoir handlebar clamp screws	72-84 **in-lbs**	8.1-9.5 Nm	2.14 FRONT BRAKE MASTER CYL-INDER, Assembly and Installation
Mirror flange nut (FLHX)	30-40 **in-lbs**	3.4-4.5 Nm	2.27 MIRRORS, FLHX/metric
Mirror stem acorn nut	60-96 **in-lbs**	6.8-10.8 Nm	2.27 MIRRORS, All Models Except FLHX/metric
Outer fairing long screws (FLTR)	10-15 **in-lbs**	1.1-1.7 Nm	2.41 UPPER FAIRING AND WINDSHIELD: FLTR, Outer Fairing
Outer fairing screws (FLHX, FLHT/C/U)	20-30 **in-lbs**	2.3-3.4 Nm	2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, Outer Fairing and Windshield
Outer fairing short screws (FLTR)	6-12 **in-lbs**	0.7-1.4 Nm	2.41 UPPER FAIRING AND WINDSHIELD: FLTR, Outer Fairing
Passenger footboard/footrest fastener	36-42 ft-lbs	48.8-56.9 Nm	2.52 FOOTBOARDS AND FOOTRESTS, Passenger Footboard
Passenger footboard/footrest fastener	36-42 ft-lbs	48.8-56.9 Nm	2.52 FOOTBOARDS AND FOOTRESTS, Passenger Footrest: FLHX
Passenger footrest pad socket head screw (FLHX)	15-20 ft-lbs	20-27 Nm	2.52 FOOTBOARDS AND FOOTRESTS, Passenger Footrest: FLHX/Use Loctite Medium Strength Threadlocker 243 (blue)
Radio bracket/inner fairing to fairing bracket stud locknuts (FLTR)	96-144 **in-lbs**	10.9-16.3 Nm	2.44 INNER FAIRING: FLTR, Installation
Rail clamp screws	30-50 **in-lbs**	3.0-6.0 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Rear axle cone nut (preliminary)	15-20 ft-lbs	20-27 Nm	2.5 REAR WHEEL, Installation/metric

FASTENER	TORQUE VALUE		NOTES
Rear brake light switch	12-15 ft-lbs	16.3-20.3 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped/Use Loctite Pipe Sealant with Teflon 565
Rear fascia flange nuts (FLHX)	30-45 **in-lbs**	3.4-5.1 Nm	2.50 REAR FASCIA: FLHX, Installation
Rear fascia flange nuts (FLHX)	30-45 **in-lbs**	3.4-5.1 Nm	2.50 REAR FASCIA: FLHX, Stud Plate
Rear fascia lamp screws (FLHX)	18-22 **in-lbs**	2.0-2.5 Nm	2.50 REAR FASCIA: FLHX, Installation
Rear fender mounting screws	15-20 ft-lbs	20-27 Nm	2.49 REAR FENDER, Installation
Rear fender support-to-fender nut	45-85 **in-lbs**	5.1-9.6 Nm	2.50 REAR FASCIA: FLHX, Stud Plate
Rear fender support -to-saddlebag support fastener	15-20 ft-lbs	20-27 Nm	2.49 REAR FENDER, Installation
Rear fender support-to-saddlebag support fastener	15-20 ft-lbs	20.3-27.1 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Rear fender support-to-saddlebag support fastener	15-20 ft-lbs	20.3-27.1 Nm	2.50 REAR FASCIA: FLHX, Stud Plate
Rear fork bracket bolts	55-65 ft-lbs	74.6-88.1 Nm	2.24 REAR FORK, Installation/Apply two drops of Loctite Medium Strength Threadlocker 243 (blue) to threads
Rear fork pivot shaft nuts	55-66 ft-lbs	74.6-89.5 Nm	2.24 REAR FORK, Installation/Apply two drops of Loctite Medium Strength Threadlocker 243 (blue) to threads
rear frame fastener	40-50 ft-lbs	54.2-67.8 Nm	2.51 REAR FRAME, Rear Frame
Rear master cylinder to engine mount end cap screws	10.5-12.5 ft-lbs	14-17 Nm	2.16 REAR BRAKE MASTER CYLINDER, Assembly and Installation
Rear master cylinder-to-frame screws	126-150 **in-lbs**	14.2-17.0 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped
Rear muffler fastener	96-144 **in-lbs**	10.8-16.3 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Rider footboard bracket socket screws	36-42 ft-lbs	48.8-57.0 Nm	2.52 FOOTBOARDS AND FOOTRESTS, Rider Footboards
Rider footboard pivot bolt nut	60-80 **in-lbs**	6.8-9.0 Nm	2.52 FOOTBOARDS AND FOOTRESTS, Rider Footboards
Saddlebag latch/check strap T15 TORX screws	20-25 **in-lbs**	2.3-2.8 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Hardware
Saddlebag latch/check strap T15 TORX screws	20-25 **in-lbs**	2.3-2.8 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Hardware
Saddlebag lid check strap T20 TORX screws	18-20 **in-lbs**	2.0-2.3 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Hardware
Saddlebag mounting bracket screw	60-96 **in-lbs**	6.8-10.8 Nm	2.28 SEAT, Seat: FLHR/C
Saddlebag mounting bracket screw	12-15 ft-lbs	16.3-20.3 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Saddlebag mounting bracket screw	12-15 ft-lbs	16.3-20.3 Nm	2.49 REAR FENDER, Installation
Saddlebag mounting bracket screw fastener	12-15 ft lbs	16.3-20.3 Nm	2.31 TOUR-PAK, Luggage Rack/Tour-Pak Support
Saddlebag mounting bracket to saddlebag support screws	12-15 ft-lbs	16.3-20.3 Nm	2.29 SADDLEBAGS, Installation
Saddlebag side guard to front guard screw	72-120 **in-lbs**	8.0-14.0 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Saddlebag support rail to front guard screw	70-100 **in-lbs**	8.0-11.0 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Saddlebag support to fender support fastener	15-20 ft-lbs	20.0-27.0 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail

FASTENER	TORQUE VALUE		NOTES
Saddlebag support to fender support fastener	15-20 ft-lbs	20-27 Nm	2.49 REAR FENDER, Installation
Seat mounting screw	48-72 **in-lbs**	5.4-8.1 Nm	2.28 SEAT, Seat: FLHT, FLTR, FLHX
Seat mounting screw	48-72 **in-lbs**	5.4-8.1 Nm	2.28 SEAT, Seat: FLHTC/U
Seat mounting screw	48-72 **in-lbs**	5.4-8.1 Nm	2.28 SEAT, Seat: FLHR/C
Seat strap screw	48-72 **in-lbs**	5.4-8.1 Nm	2.28 SEAT, Seat: FLHT, FLTR, FLHX
Seat strap screw	48-72 **in-lbs**	5.4-8.1 Nm	2.28 SEAT, Seat: FLHTC/U
Shock lower mounting bolt	35-40 ft-lbs	47.5-54.2 Nm	2.23 REAR SHOCK ABSORBERS, Installation/Use LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (blue)
Shock lower mounting bolt	35-40 ft-lbs	47-54 Nm	2.24 REAR FORK, Installation/Apply two or three drops of Loctite Medium Strength Threadlocker 243 (blue) to threads
Shock upper mounting bolt	35-40 ft-lbs	47.5-54.2 Nm	2.23 REAR SHOCK ABSORBERS, Installation/Use LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (blue)
Side rail to saddlebag support screws	15-20 ft-lbs	20.0-27.0 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Speaker box mounting bolts	25-35 **in-lbs**	2.8-4.0 Nm	2.31 TOUR-PAK, Removal/Installation
Speedometer/tachometer bracket screws	10-20 **in-lbs**	1.1-2.3 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
Spoke nipple	55 **in-lbs**	6.2 Nm	2.8 WHEEL LACING: 16 INCH FRONT RIM, Procedure
Spoke nipple	55 **in-lbs**	6.2 Nm	2.9 WHEEL LACING: 16 INCH REAR RIM, Procedure
Spoke nipple	55 **in-lbs**	6.2 Nm	2.10 WHEEL LACING: 17 INCH RIM, Procedure
Spoke nipple	55 **in-lbs**	6.2 Nm	2.12 TRUING LACED WHEELS, Radial Truing
Top caddy fastener	72-96 **in-lbs**	8.1-10.8 Nm	2.51 REAR FRAME, Rear Frame
Tour-Pak lockset hex nut	25-35 **in-lbs**	2.8-4.0 Nm	2.32 TOUR-PAK SERVICE, Lockset
Tour-Pak lockset hex nut	25-35 **in-lbs**	2.8-4.0 Nm	2.35 TOUR-PAK SPEAKER BOX: FLHTCU, Speaker Box (FLHTCU)
Tour-Pak lockset jam nut	30-45 **in-lbs**	3.4-5.1 Nm	2.32 TOUR-PAK SERVICE, Lockset
Tour-Pak metal plate flange nuts	65-70 **in-lbs**	7.3-7.9 Nm	2.33 TOUR-PAK LIGHTS, Tour-Pak Lights Harness
Tour-Pak mounting bolts	96-120 **in-lbs**	10.8-13.6 Nm	2.31 TOUR-PAK, Removal/Installation
Tour-Pak mounting bolts	96-120 **in-lbs**	10.8-13.6 Nm	2.31 TOUR-PAK, Adjustment
Tour-Pak mounting bolts	96-120 **in-lbs**	10.8-13.6 Nm	2.33 TOUR-PAK LIGHTS, Tour-Pak Lights Harness
Tour-Pak passenger backrest flange nuts	40-60 **in-lbs**	4.5-6.8 Nm	2.32 TOUR-PAK SERVICE, Tether Brackets
Tour-Pak passenger backrest flange nuts	40-60 **in-lbs**	4.5-6.8 Nm	2.34 TOUR-PAK BACKREST, Passenger Backrest
Tour-Pak passenger backrest flap T25 TORX screws	21-24 **in-lbs**	2.4-2.7 Nm	2.34 TOUR-PAK BACKREST, Passenger Backrest Flap (FLHTCU)
Tour-Pak side marker lights T15 TORX screws	20-25 **in-lbs**	2.3-2.8 Nm	2.33 TOUR-PAK LIGHTS, Side Marker Lights (FLHTCU)
Tour-Pak tether T15 TORX screw	20-25 **in-lbs**	2.3-2.8 Nm	2.32 TOUR-PAK SERVICE, Hinges/Use Loctite High Strength Threadlocker 262 (red)
Tour-Pak tether T15 TORX screw	20-25 **in-lbs**	2.3-2.8 Nm	2.32 TOUR-PAK SERVICE, Latches/Lockset Catch/Use Loctite Medium Strength Threadlocker 243 (blue)
Tour-Pak tether T15 TORX screw	20-25 **in-lbs**	2.3-2.8 Nm	2.32 TOUR-PAK SERVICE, Latches/Lockset Catch/Use Loctite Medium Strength Threadlocker 243 (blue)

FASTENER	TORQUE VALUE		NOTES
Tour-Pak tether T15 TORX screw	20-25 **in-lbs**	2.3-2.8 Nm	2.32 TOUR-PAK SERVICE, Tether/Use Loctite High Strength Threadlocker 262 (red)
Transmission lubricant drain plug	14-21 ft-lbs	19-28 Nm	2.25 CLUTCH CABLE, Installation
Valve stem nut	12-15 **in-lbs**	1.4-1.7 Nm	2.18 TIRES, Installation
Windshield screws (FLHX, FLHT/C/U)	25-30 **in-lbs**	2.8-3.4 Nm	2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, Outer Fairing and Windshield
Windshield wellnut screws (FLTR)	6-13 **in-lbs**	0.7-1.5 Nm	2.41 UPPER FAIRING AND WINDSHIELD: FLTR, Windshield
Windshield window T27 TORX screws (Road King Models)	20-25 **in-lbs**	2.3-2.8 Nm	2.46 WINDSHIELD: FLHR/C, Windshield Window

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

SPECIFICATIONS 2.2

SPECIFICATIONS

Chassis Specifications

Table 2-1. Dimensions: 2009 FLHT, FLHTC/U, FLTR and FLHX

ITEM	FLHT		FLHTC		FLHTCU		FLTR		FLHX	
	IN.	MM	IN.	MM	IN.	MM	IN.	MM	IN.	MM
Wheel base	63.54	1613.92	63.54	1613.92	63.54	1613.92	63.54	1613.92	63.54	1613.92
Overall length (Tour-Pak in rearmost position)	95.02	2413.51	98.30	2496.82	98.63	2502.20	94.10	2390.14	95.08	2415.03
Overall width	38.00	965.20	38.00	965.20	38.00	965.20	35.80	909.32	38.00	965.20
Road clearance	5.10	129.54	5.10	129.54	5.10	129.54	5.10	129.54	4.70	119.38
Overall height	61.00	1549.49	61.00	1549.49	61.00	1549.49	55.00	1397.00	52.20	1325.88
Saddle height*	27.30	693.42	27.30	693.42	27.30	693.42	26.90	683.26	26.30	668.02
*With 180 lb. (81.7 kg) rider on seat										

Table 2-2. Dimensions: 2009 FLHR and FLHRC

ITEM	FLHR		FLHRC	
	IN.	MM	IN.	MM
Wheel base	63.54	1613.92	63.54	1613.92
Overall length	95.02	2413.51	94.22	2393.19
Overall width	37.40	949.96	37.50	952.50
Road clearance	5.10	129.54	5.10	129.54
Overall height	55.10	1399.54	55.10	1399.54
Saddle height*	27.30	693.42	26.90	683.26
*With 180 lb. (81.7 kg) rider on seat				

Table 2-3. Capacities: 2009 Touring Models

ITEM	U.S.	LITERS
Fuel tank (total)	6.00 gal	22.71
Low fuel warning light on	1.00 gal	3.79
Oil tank with filter	4.00 qt.	3.79
Transmission (approximate)	1.00 qt.	0.95
Primary chaincase (approximate)	1.40 qt.	1.32

Table 2-4. Weights: 2009 FLHT, FLHTC/U, FLTR and FLHX

ITEM	FLHT		FLHTC		FLHTCU		FLTR		FLHX	
	LB.	KG	LB.	KG	LB.	KG	LB.	KG	LB.	KG
Weight as shipped from factory	774.00	351.08	827.00	375.12	852.00	386.46	783.00	355.16	773.00	350.63
GVWR	1360.00	616.89	1360.00	616.89	1360.00	616.89	1360.00	616.89	1360.00	616.89
GAWR front	500.00	226.80	500.00	226.80	500.00	226.80	500.00	226.80	500.00	226.80
GAWR rear	927.00	420.48	927.00	420.48	927.00	420.48	927.00	420.48	927.00	420.48

Table 2-5. Weights: 2009 FLHR and FLHRC

ITEM	FLHR		FLHRC	
	LB.	KG	LB.	KG
Weight as shipped from factory	775.00	351.53	773.00	350.63
GVWR	1360.00	616.89	1360.00	616.89
GAWR front	500.00	226.80	500.00	226.80
GAWR rear	927.00	420.48	927.00	420.48

NOTES

- *Gross vehicle weight rating (GVWR) (maximum allowable loaded vehicle weight) and corresponding gross axle weight rating (GAWR) are given on a label located on the frame steering head.*
- *For important information regarding tire data and tire inflation, see 1.10 TIRES AND WHEELS.*

Tire Specifications

⚠WARNING

Use only Harley-Davidson approved tires. See a Harley-Davidson dealer. Using non-approved tires can adversely affect stability, which could result in death or serious injury. (00024a)

Tire sizes are molded on the sidewall. Refer to the tire fitment tables below. Rim size and contour are cast or stamped into the exterior surface of the rim.

Example: T19 x 2.15 MT DOT. "T" indicates that the rim conforms to Tire and Rim Association standards. The "19" is the normal diameter of the rim in inches, measured at the bead seat diameter. The "2.15" is the width of the bead seat measured in inches. "MT" designates the rim contour. "DOT" means that the rim meets Department of Transportation Federal Motor Vehicle Safety Standards.

Table 2-6. Tire Fitment - Tubeless Cast Wheels

WHEEL SIZE AND POSITION	RIM SIZE AND CONTOUR	RIM VALVE HOLE DIA.	TIRE SIZE
17 in. - Front	T17 x 3.00 MT	0.45 in. (11.4 mm)	**Dunlop D407F** 130/80B17 65H
16 in. - Rear	T16 x 5.00 MT	0.45 in. (11.4 mm)	**Dunlop D407** 180/65B16 81H

Table 2-7. Tire Fitment - Tube Type Steel Laced Wheels

WHEEL SIZE & POSITION	RIM SIZE & CONTOUR	TUBE SIZE	TIRE SIZE
16 in - Front	T16 x 3.00D	MT90-16/MU85-16	**Dunlop D407F** 130/90-B16 67H
16 in - Rear	T16 x 5.00 MT	180/65-16	**Dunlop D407** 180/65-16 81H

Table 2-8. Tire Fitment - Tube Type Chrome Aluminum Profile Laced Wheels

WHEEL SIZE & POSITION	RIM SIZE & CONTOUR	TUBE SIZE	TIRE SIZE
16 in - Front	T16 x 3.00 MT	MT90-16/MU85-16 130/90-150/80-16	**Dunlop D407F** 130/90B16 67H
17 in - Front	T17 x 3.00 MT	130/80-17	**Dunlop D407F** 130/80-B17 65H
16 in - Rear	T16 x 5.00 MT	180/65-16	**Dunlop D407** 180/65-16 81H

Table 2-9. Tire Pressures: 2009 Touring Models

MODEL	TIRE PRESSURE (COLD)			
	FRONT		REAR	
	PSI	kPa	PSI	kPa
All	36	248	40	276

VEHICLE IDENTIFICATION NUMBER (V.I.N.) 2.3

VEHICLE IDENTIFICATION NUMBER: TOURING MODELS

The full 17-digit serial number, or Vehicle Identification Number (V.I.N.), is stamped on the right side of the frame backbone at the rear of the steering head. A label bearing the V.I.N. code is also affixed to the left side of the steering head.

An abbreviated V.I.N. is stamped between the front and rear cylinders on the left side of the crankcase.

NOTE

Always give the full 17-digit Vehicle Identification Number when ordering parts or making any inquiry about your motorcycle.

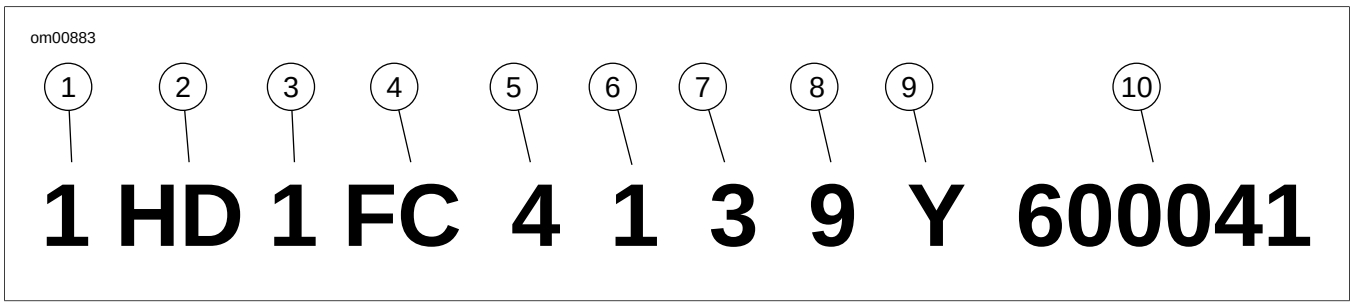


Figure 2-1. Typical Harley-Davidson V.I.N.: 2009 Touring Models

Table 2-10. Harley-Davidson V.I.N. Breakdown: 2009 Touring Models

POSITION	DESCRIPTION	POSSIBLE VALUES
1	Market designation	1=Originally manufactured for sale **within** the United States 5=Originally manufactured for sale **outside** of the United States
2	Manufacturer	HD=Harley-Davidson
3	Motorcycle type	1=Heavyweight motorcycle (901 cc or larger)
4	Model	See V.I.N. model table
5	Engine type	4=Twin Cam 96™, 1584 cc air-cooled, fuel-injected
6	Introduction date	1=Regular 2=Mid-year 3=California/regular 4=Cosmetic changes and/or special introductory date 5=California/cosmetic changes and/or special introductory date 6=California/mid-year
7	V.I.N. check digit	Can be 0-9 or X
8	Model year	9=2009
9	Assembly plant	Y=York, PA U.S.A.
10	Sequential number	Varies

Table 2-11. V.I.N. Model Codes: 2009 Touring Models

CODE	MODEL	CODE	MODEL
FB	FLHR Road King®	FC	FLHTCU Ultra Classic® Electra Glide®
FG	FLHTCU Ultra Classic® Electra Glide® with sidecar	FL	FLHTCU Ultra Classic® Electra Glide® Shrine
FS	FLTR Road Glide®	FV	FLHT Electra Glide®
FF	FLHTC Electra Glide® Classic	KB	FLHX Street Glide™
FW	FLHR Road King® Shrine	FR	FLHRC Road King® Classic

FRONT WHEEL 2.4

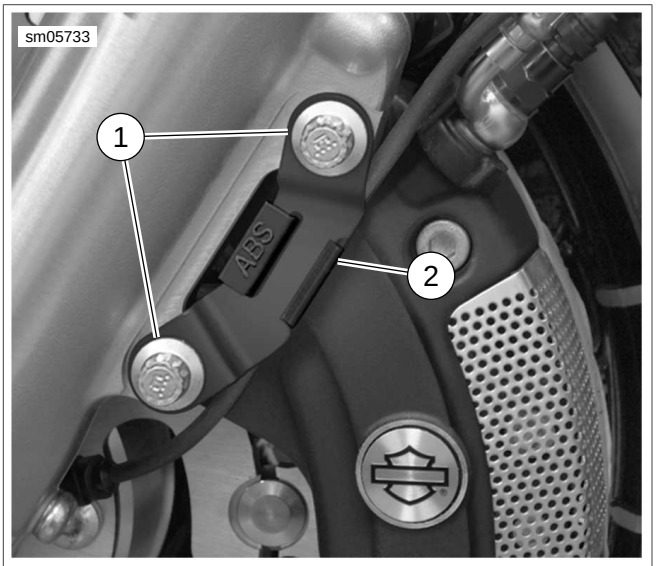
REMOVAL

1. Place the motorcycle on a hydraulic center stand with the front wheel raised off the ground.
2. Inspect wheel bearings. See 2.11 SEALED WHEEL BEARINGS.
3. If present, carefully cut three cable straps to release front wheel speed sensor cable and front fender tip lamp wires from left caliper brake hose.
4. See Figure 2-2. Remove two brake caliper mounting fasteners (1). Slide brake caliper straight down to remove from brake disc. Secure caliper to rail of engine guard using cable strap.
5. If necessary, remove clip (2) to release wheel speed sensor harness from bracket.
6. Remove brake caliper on right side of wheel.

NOTE

Do not operate the front brake hand lever with the front wheel removed or the caliper pistons may be forced out. Reseating pistons requires disassembly of the brake caliper.

7. See Figure 2-3. Insert screwdriver or steel rod through hole in axle (11) on right side of motorcycle. While holding axle stationary, remove the axle nut (1) and flat washer (2).
8. Loosen the two axle holder nuts at bottom of right side fork slider.



1. Caliper fasteners
2. Wheel speed sensor cable retainer

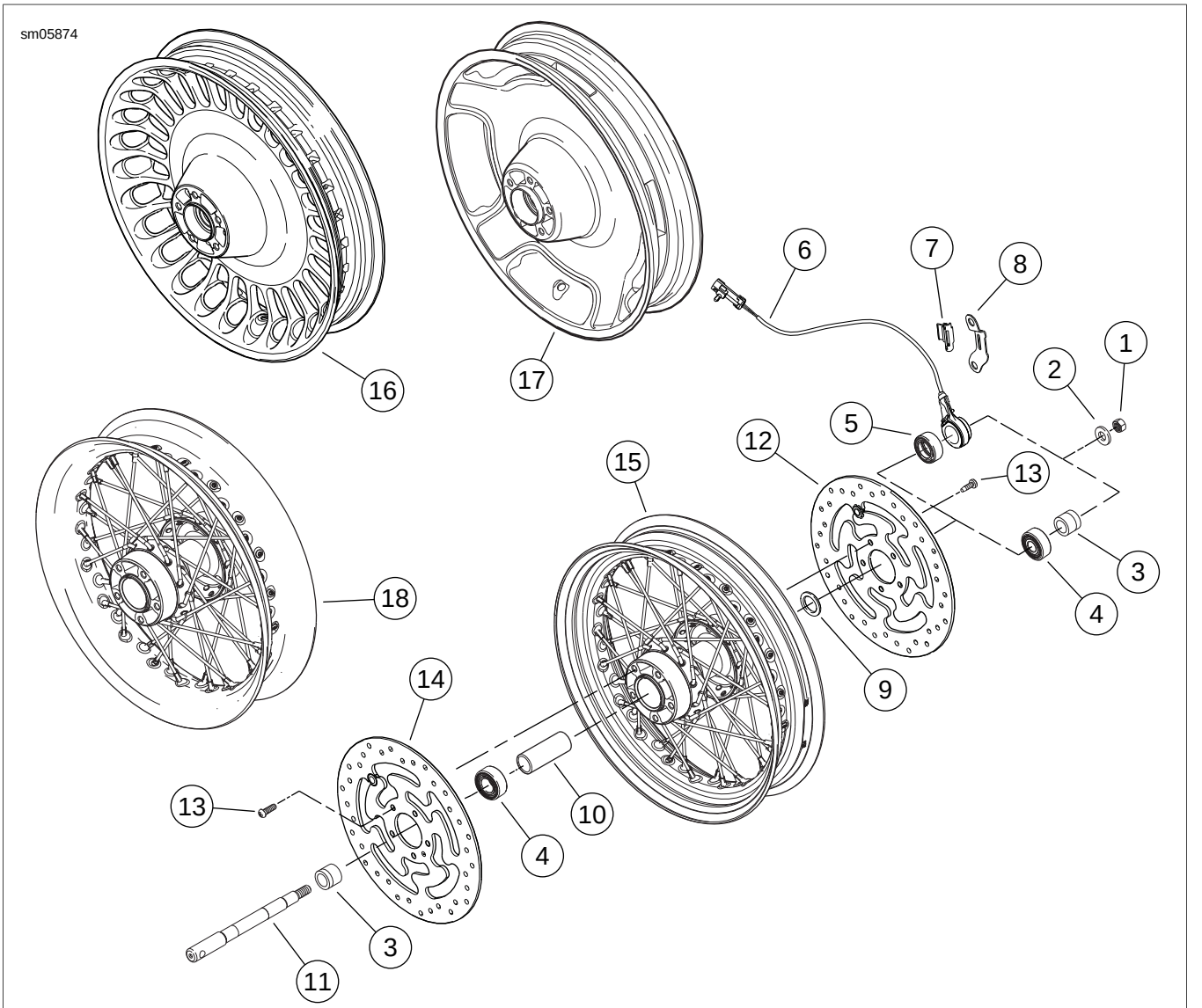
Figure 2-2. Remove Front Caliper

9. Using a soft mallet, gently tap end of axle towards right side of motorcycle. Catching external spacer(s), pull axle free from fork sliders, front wheel speed sensor (if ABS equipped), and wheel hub.

NOTE

If ABS equipped, never pull wheel speed sensor cable taut or use to retain wheel, axle or other components. Always keep wheel speed sensor (and ABS encoder bearing) away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur.

10. If necessary, remove five screws (13) to release brake discs from hub.



1. **Axle nut**
2. **Flat washer**
3. **External spacer**
4. **Standard bearing**
5. **ABS encoder bearing**
6. **Front wheel speed sensor**
7. **Cable clip**
8. **Clip bracket**
9. **Spacer washer**
10. **Spacer sleeve**
11. **Axle**
12. **Brake disc (left side)**
13. **T40 TORX screw (10)**
14. **Brake disc (right side)**
15. **Laced wheel, chrome**
16. **Cast wheel**
17. **Slotted cast wheel**
18. **Laced wheel, smoothie**

Figure 2-3. Front Wheel (Exploded View)

CLEANING AND INSPECTION

1. Thoroughly clean all parts in solvent (wheel speed sensor and bearings excepted) and inspect for damage or excessive wear.
2. Replace brake discs if warped or badly scored. Measure disc thickness for excessive wear. Minimum acceptable thickness is stamped on side of disc.

INSTALLATION

1. See Figure 2-3. If removed, install five **new** screws (13) to fasten brake discs to hub. Alternately tighten screws to 16-24 ft-lbs (22-33 Nm).
2. Place wheel into position between fork sliders with the valve stem on the right side of the motorcycle.

3. Apply a light coat of LOCTITE ANTI-SEIZE lubricant to axle, bearing bores and bore of spacer sleeve.
4. Slide axle through right fork slider and external spacer into wheel hub.

NOTE

Be sure that grooves on external spacer(s), or index pin on front wheel speed sensor (if ABS equipped), are on the outboard side. If motorcycle is not ABS equipped, external spacers on left and right side of wheel hub are interchangeable.

5. Push axle through front wheel speed sensor (if ABS equipped) or second external spacer, and left fork slider.
6. Install flat washer and axle nut.
7. See Figure 2-4. If ABS equipped, rotate front wheel speed sensor in a counter-clockwise direction until index pin makes contact with shoulder on left fork slider.
8. Hold axle stationary, tighten axle nut to 60-65 ft-lbs (81.4-88.1 Nm).
9. Push and hold right fork slider inboard until it contacts external spacer and tighten axle holder nuts to 132-180 **in-lbs** (14.9-20.3 Nm).

NOTE

See Figure 2-3. If removed, secure wheel speed sensor cable in bracket (8). Be sure that tab (stamped ABS) on clip is installed in slot of bracket from inboard side. Clip cannot be installed once mounting fasteners are started.

10. Install left side brake caliper. See 2.15 FRONT BRAKE CALIPER.

⚠WARNING

After servicing brakes and before moving motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00279a)

11. Depress front brake hand lever several times to set brake pads to proper operating position within caliper.
12. If ABS equipped, install three **new** cable straps as follows:
 a. Install cable strap on the brake hose lower crimp capturing front wheel speed sensor cable and brake hose.
 b. Approximately midway between the upper and lower brake hose crimps capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.
 c. Install cable strap 2.5 in. (63.5 mm) below the brake hose upper crimp capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.

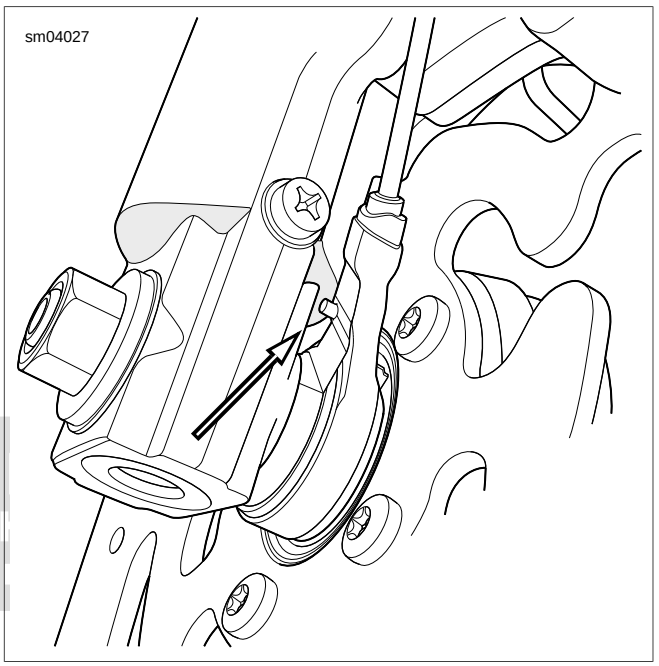


Figure 2-4. Front Wheel Speed Sensor Index Pin (ABS Equipped)

REAR WHEEL 2.5

REMOVAL

PART NUMBER	TOOL NAME
HD-47925	AXLE NUT TORQUE ADAPTER

1. Remove saddlebags. See 2.29 SADDLEBAGS.
2. Place motorcycle on center stand with the rear wheel raised off the ground.
3. Inspect wheel bearings. See 2.11 SEALED WHEEL BEARINGS.
4. Remove left side muffler. See 4.19 EXHAUST SYSTEM.
5. On models equipped with low profile shock absorbers (FLHX), remove left side lower saddlebag support rail. See 2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail.
6. **ABS equipped:** Cut cable strap to release rear wheel speed sensor cable from rear brake hose.
7. Remove rear brake caliper but do not disconnect the brake hose. Set brake caliper on passenger footboard. See 2.17 REAR BRAKE CALIPER.

NOTE

Do not operate the rear brake pedal with the caliper removed or the caliper pistons may be forced out. Reseating pistons requires disassembly of the caliper.

8. See Figure 2-5. Remove E-clip (1) from groove at end of axle.
9. See Figure 2-6. Hold weld nut on left side and loosen cone nut using AXLE NUT TORQUE ADAPTER (Part No. HD-47925).
10. Remove cone nut and adjuster cam from axle.
11. Rotate weld nut on opposite side of axle in a counter-clockwise direction until wheel is loose.

NOTE

If ABS equipped, never pull wheel speed sensor cable taut or use to retain wheel, axle or other components. Always keep wheel speed sensor (and ABS encoder bearing) away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur.

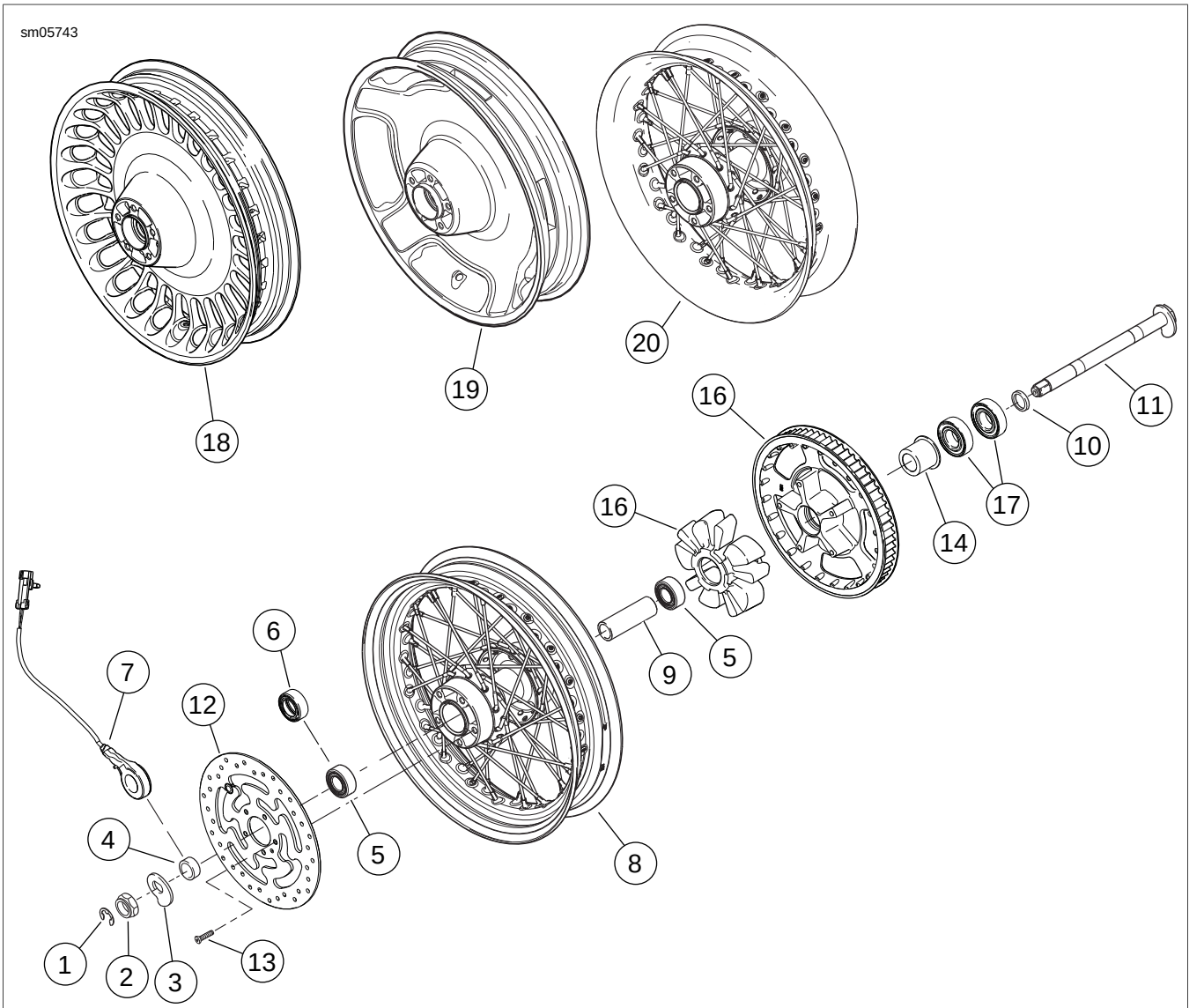
12. Using a soft mallet, gently tap end of axle towards left side of motorcycle. Catching external spacer(s), pull axle free of rear fork, caliper bracket, rear wheel speed sensor (if ABS equipped), and wheel hub.
13. Remove caliper bracket from anchor weldment on rear fork.
14. Move wheel forward and slip belt off compensator sprocket.

NOTE

Hold compensator sprocket while removing rear wheel. Compensator sprocket may drop from wheel if isolators are excessively worn.

15. If necessary, remove brake disc from hub. If wheel is to be assembled with the same disc, mark both the wheel and disc, so that it can be installed in its original position.

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1. **E-clip**
2. **Cone nut**
3. **Adjuster cam**
4. **External spacer (thick)**
5. **Standard bearing**
6. **ABS encoder bearing**
7. **Rear wheel speed sensor**
8. **Laced wheel, chrome**
9. **Spacer sleeve**
10. **External spacer (thin)**
11. **Axle**
12. **Brake disc**
13. **Screw (5)**
14. **Spacer, compensator**
15. **Isolator**
16. **Compensator sprocket**
17. **Sprocket bearing (2)**
18. **Cast wheel**
19. **Slotted cast wheel**
20. **Laced wheel, smoothie**

Figure 2-5. Rear Wheel (Exploded View)

CLEANING AND INSPECTION

1. Thoroughly clean all parts in solvent (wheel speed sensor and bearings excepted) and inspect for damage or excessive wear.
2. Replace brake disc if warped or badly scored. Measure disc thickness for excessive wear. Minimum acceptable thickness is stamped on side of disc.
3. Check the compensator sprocket for wear, tooth damage, cracks or pitting. Check isolator for crumbling, flaking, excessive wear or general deterioration. Replace parts as necessary.

INSTALLATION

PART NUMBER	TOOL NAME
HD-35381A	BELT TENSION GAUGE

1. If removed, install brake disc using five **new** screws. Alternately tighten screws to 30-45 ft-lbs (41-61 Nm). Always install brake disc in its original position.
2. Verify that compensator sprocket is square and fully seated in bowl area of wheel.
3. Place wheel in rear fork. Install belt over compensator sprocket and slide the wheel back.

⚠WARNING

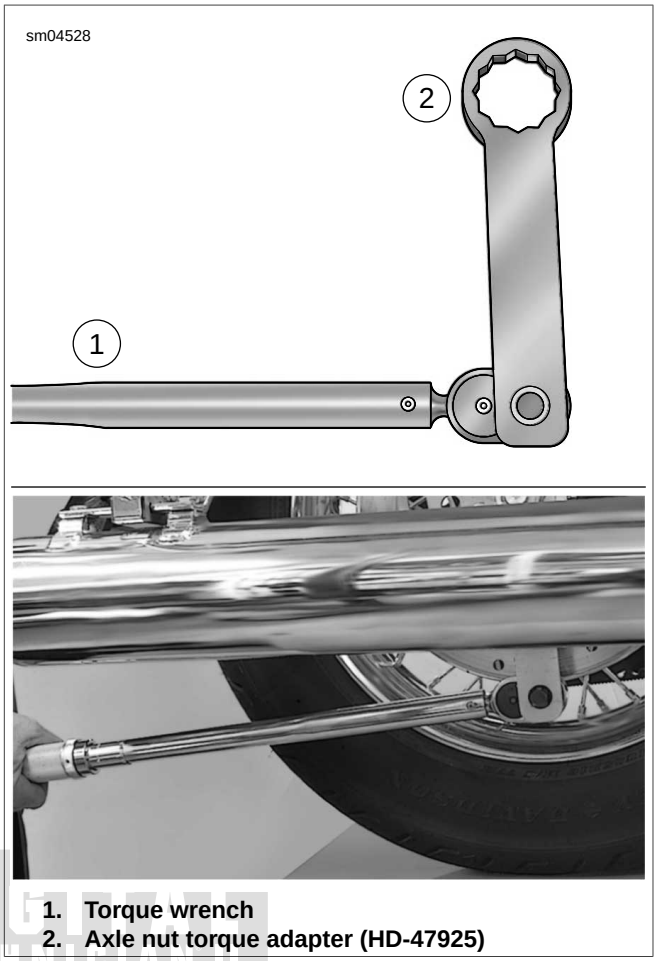
Never bend belt forward into a loop smaller than the drive sprocket diameter. Never bend belt into a reverse loop. Over bending can damage belt resulting in premature failure, which could cause loss of control and death or serious injury. (00339a)

4. Seat caliper bracket on anchor weldment of rear fork.
5. Apply a light coat of anti-seize lubricant to axle, bearing bores and bore of spacer sleeve.
6. Slide axle through left side of rear swingarm, external spacer (thin), and rear wheel compensator sprocket into wheel hub.

NOTE

Be sure that grooves on external spacer, or index pin on rear wheel speed sensor (if ABS equipped), are on the outboard side.

7. Push axle through rear wheel speed sensor (if ABS equipped) or external spacer (thick), caliper bracket, and right side of rear fork.
8. Rotate axle so that the flat on the threaded end is topside. With the cam forward, install adjuster cam on end of axle.
9. Apply a thin film of anti-seize lubricant to the inboard side of the cone nut avoiding contact with threads. Install cone nut on axle. Finger tighten only.



1. **Torque wrench**
2. **Axle nut torque adapter (HD-47925)**

Figure 2-6. Install Tool Perpendicular to Torque Wrench

10. If ABS equipped, route sensor cable forward and outboard of caliper bracket. Continue forward following top of rear fork. Rotate rear wheel speed sensor in a counter-clockwise direction until index pin makes contact with caliper bracket at point shown in Figure 2-7.
11. Tighten the cone nut to 15-20 ft-lbs (20-27 Nm).
12. Install brake caliper and tighten screws to 43-48 ft-lbs (58.3-65.1 Nm).
13. Secure rear wheel speed sensor cable to brake hose with the conduit clip located approximately 1.25 in. (31.8 mm) in front of the brake hose crimp.
14. Adjust drive belt using BELT TENSION GAUGE (Part No. HD-35381A). See 1.13 REAR BELT DEFLECTION.
15. Install a **new** E-clip with the flat side out in groove on right side of axle.
16. On models equipped with low profile shock absorbers (FLHX), install left side lower saddlebag support rail. See 2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail.

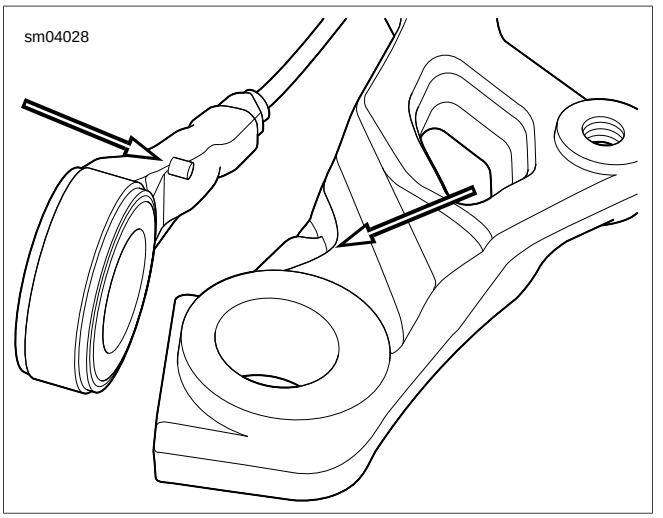


Figure 2-7. Rear Wheel Speed Sensor Index Pin (ABS Equipped)

17. Install left side muffler. See 4.19 EXHAUST SYSTEM.

WARNING

After servicing brakes and before moving motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00279a)

18. Depress rear brake pedal several times to set brake pads to proper operating position within caliper.
19. Install saddlebags. See 2.29 SADDLEBAGS.

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REAR WHEEL COMPENSATOR 2.6

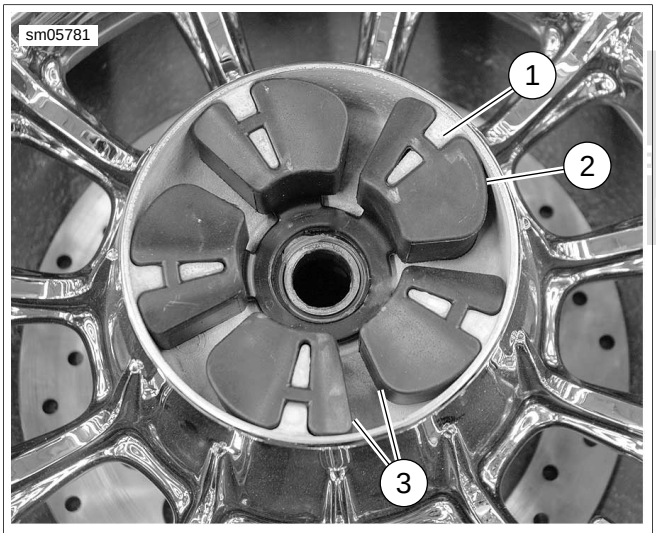
ISOLATOR REPLACEMENT

Removal

1. Remove rear wheel. See 2.5 REAR WHEEL.
2. Pull sprocket from wheel.
3. Remove isolator from wheel.

Installation

1. See Figure 2-8. Lubricate each segment (2) of **new** isolator with 50/50 mix of isopropyl alcohol and water. Do not use a petroleum based lubricant.
2. Push isolator into wheel. Verify that each isolator segment bottoms in bowl area of wheel and that each segment is flush against side walls of rib (1).
3. Using a 50/50 mix of isopropyl alcohol and water, lubricate sides of each isolator segment sprocket lug gaps (3).
4. Aligning lugs on sprocket with gaps between isolator segments, push sprocket onto wheel.
5. Install rear wheel. See 2.5 REAR WHEEL.



1. **Rib**
2. **Isolator segment**
3. **Sprocket lug gap**

Figure 2-8. Install Isolator in Wheel

SPROCKET BEARING REPLACEMENT

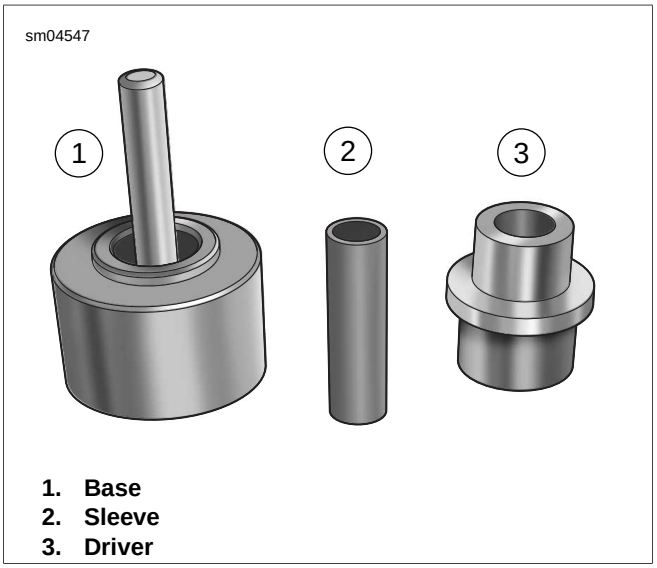
PART NUMBER	TOOL NAME
HD-48921	REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER

Removal

1. Remove rear wheel. See 2.5 REAR WHEEL.
2. Pull sprocket from wheel.
3. See Figure 2-9 and upper frame of Figure 2-10. Support base (1) of REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER (Part No. HD-48921) on press with the large OD topside and long pin (3) down.
4. Slide sleeve (2) over short pin.
5. See lower frame of Figure 2-10. With the inboard side facing up, slide sprocket over sleeve until it rests on base.
6. Slide small OD of driver (6) over sleeve until contacts spacer (5).
7. Center driver under ram and apply pressure until bearings drop into base. Disassemble tool and discard bearings.

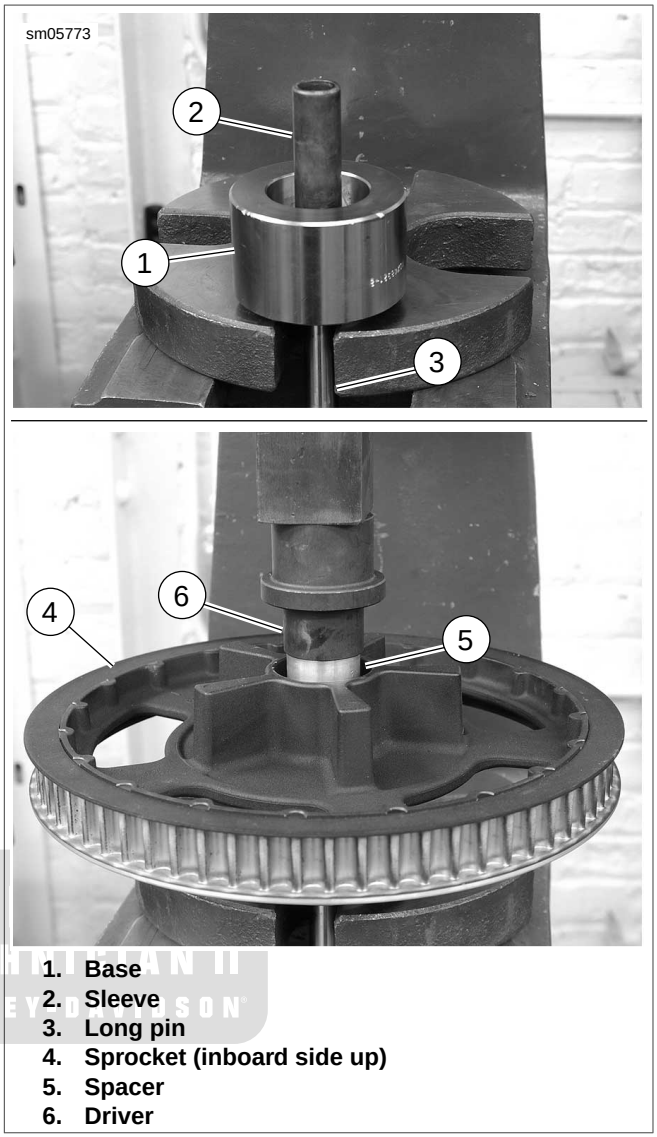
Installation

1. See upper frame of Figure 2-10. Support base (1) of REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER (Part No. HD-48921) on deck of arbor press with the large OD topside and long pin (3) down.
2. Slide sleeve (2) over short pin.
3. Verify that sprocket bearing bore is clean and dry.
4. See upper frame of Figure 2-11. With the outboard side facing up, slide sprocket over sleeve until it rests on base.
5. Place spacer (1) in sprocket with small diameter facing down.
6. Set bearing in place.
7. See lower frame of Figure 2-11. Center large OD of driver (2) on bearing. Verify the driver contacts the outer bearing race (4) all the way around.
8. Center driver under ram and apply pressure until bearing makes firm contact with counterbore in sprocket.
9. Repeat with second bearing.
10. Using a 50/50 mix of isopropyl alcohol and water, lubricate sides of each isolator segment where contact occurs with sprocket lugs.
11. Install sprocket onto wheel.
12. Install rear wheel. See 2.5 REAR WHEEL.



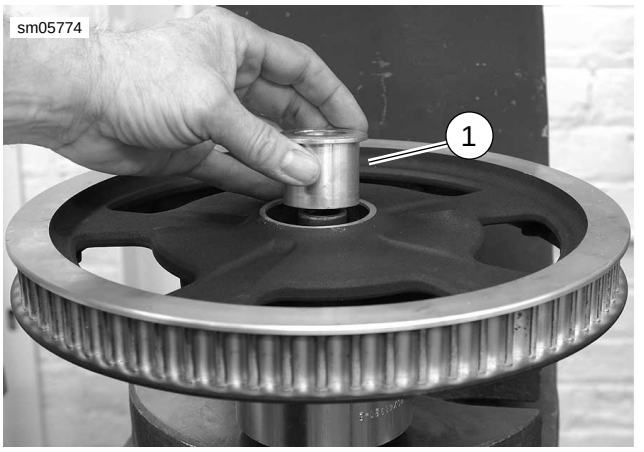
1. Base
2. Sleeve
3. Driver

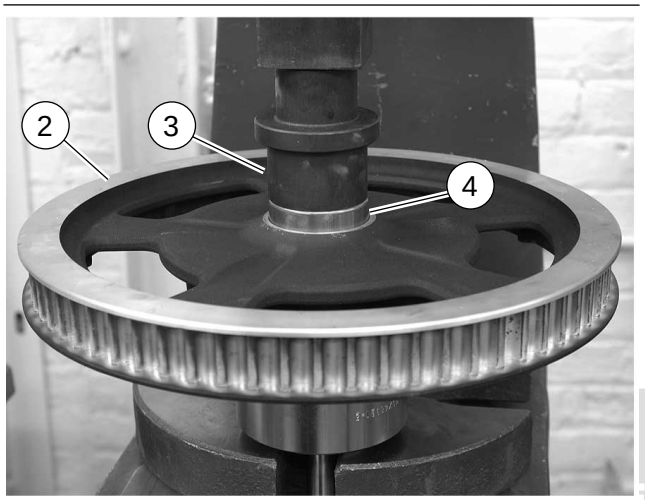
Figure 2-9. Rear Wheel Compensator Bearing Remover/Installer (HD-48921)



1. Base
2. Sleeve
3. Long pin
4. Sprocket (inboard side up)
5. Spacer
6. Driver

Figure 2-10. Remove Compensator Sprocket Bearing





1. Spacer
2. Sprocket (outboard side up)
3. Driver
4. Bearing outer race

Figure 2-11. Install Compensator Sprocket Bearing

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CHECKING RIM RUNOUT 2.7

INSPECTION

PART NUMBER	TOOL NAME
HD-99500-80	WHEEL TRUING STAND

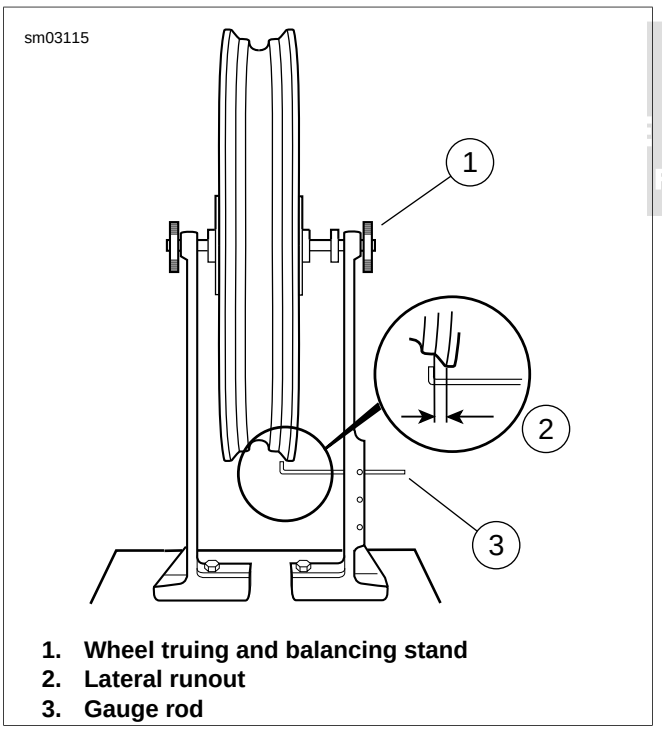
Check wheels for lateral and radial runout before installing a new tire or tube.

1. Install truing arbor in wheel hub and place wheel in WHEEL TRUING STAND (Part No. HD-99500-80).
2. See Figure 2-12. To check rim lateral runout, place a gauge rod or dial indicator near the rim bead. If lateral runout exceeds 0.040 in. (1.02 mm), replace the wheel if cast. Retrue the wheel if laced.
3. See Figure 2-13. Check the rim radial runout as shown. If radial runout exceeds 0.030 in. (0.76 mm), replace the wheel if cast. Retrue the wheel if laced.

NOTE

Rim lateral and radial runout is adjustable on laced wheels. See 2.12 TRUING LACED WHEELS.

4. If working with a laced wheel, proceed to 2.12 TRUING LACED WHEELS to check the wheel offset dimension.



1. **Wheel truing and balancing stand**
2. **Lateral runout**
3. **Gauge rod**

Figure 2-12. Checking Cast Wheel Lateral Runout

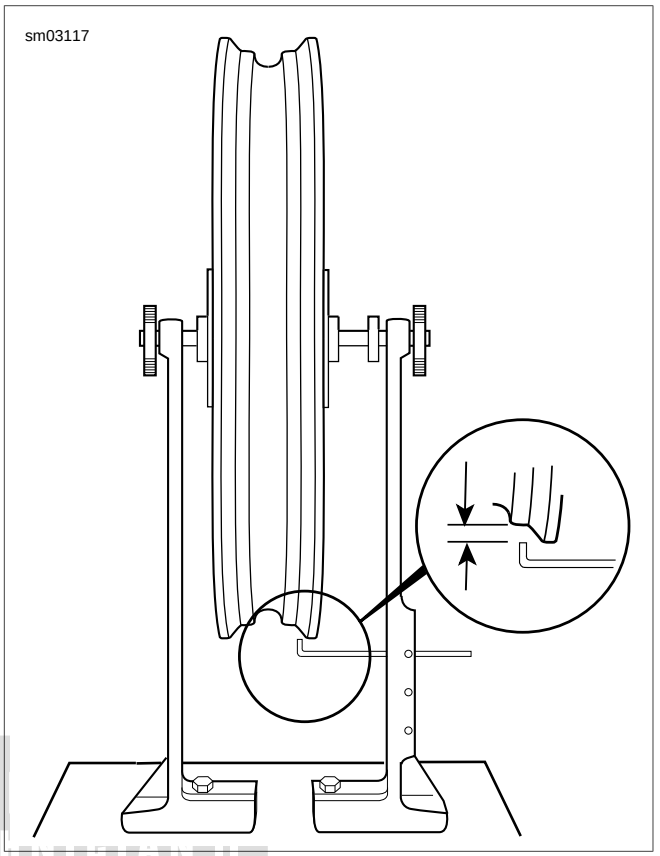


Figure 2-13. Rim Radial Runout

WHEEL LACING: 16 INCH FRONT RIM 2.8

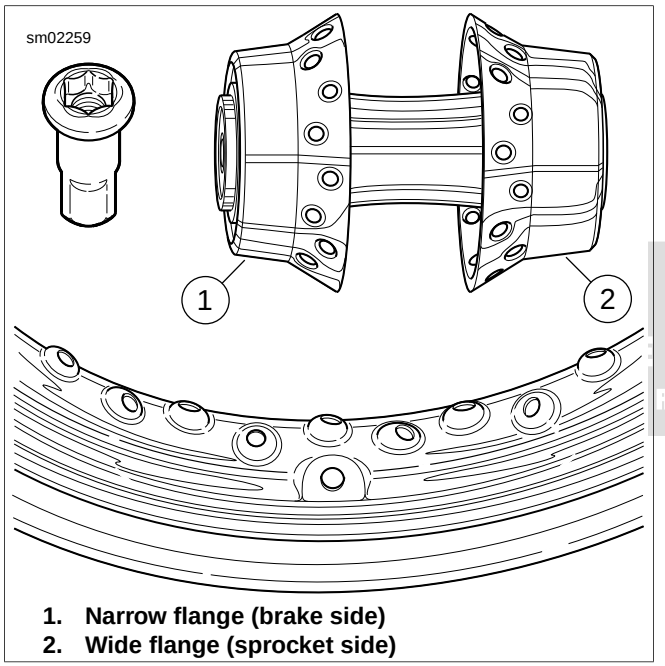
GENERAL

PART NUMBER	TOOL NAME
HD-42135	T-30 I.P. (TORX PLUS) DRIVER

NOTE

Do not install incorrect spokes or spoke nipples on rim. Steel laced rims use zinc plated spokes and spoke nipples. Chrome aluminum profile laced rims use chrome plated spokes and spoke nipples. Using incorrect spokes can result in improper thread engagement which could result in damage to rim, tubes or tire.

The spoke nipple fittings use a TORX style fastener and requires a special T-30 I.P. (TORX PLUS) DRIVER (Part No. HD-42135) for removal and installation. See Figure 2-14. Use of a standard T-30 TORX bit will result in nipple damage.



1. **Narrow flange (brake side)**
2. **Wide flange (sprocket side)**

Figure 2-14. Rim, Hub and Spoke Nipple

PROCEDURE

1. See Figure 2-15. If front wheel, place hub on table with wider flange side up. If rear wheel, place hub on table with narrow flange (brake disc side) up. Insert a spoke in each hole of **lower** row as shown in the figure. Angle spokes clockwise.

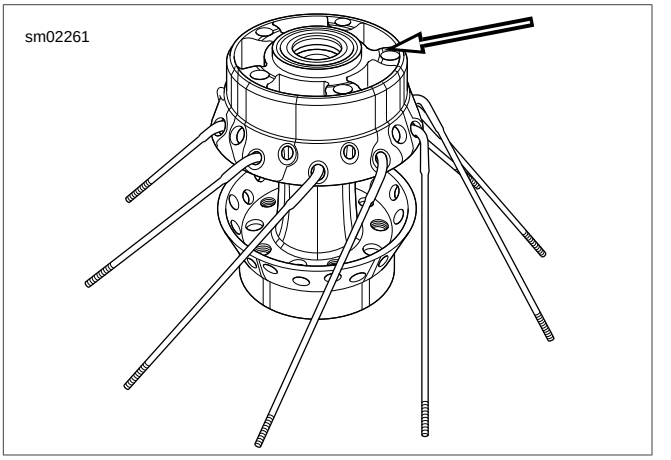


Figure 2-15. Hub: Primary Brake Disc Side Up

2. See Figure 2-16. Center rim over hub assembly with valve stem hole facing upward.
3. Using any **lower** row spoke, place first spoke into rim hole to left of valve stem hole on upper half of rim centerline.

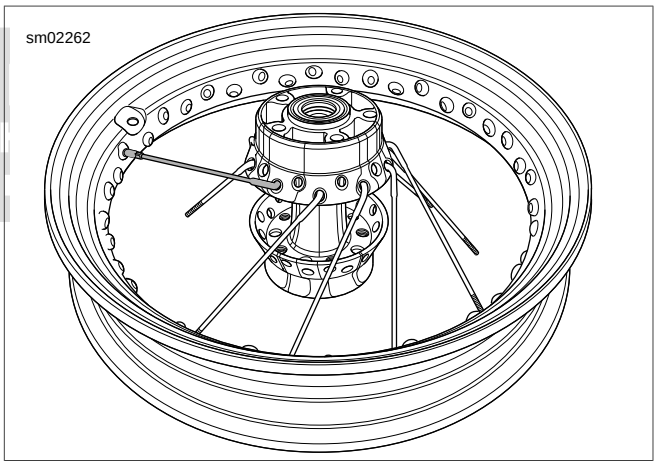


Figure 2-16. Brake Side Up: Start First Spoke of Bottom Row

4. See Figure 2-17. Install remaining lower row spokes, one in every fourth hole.

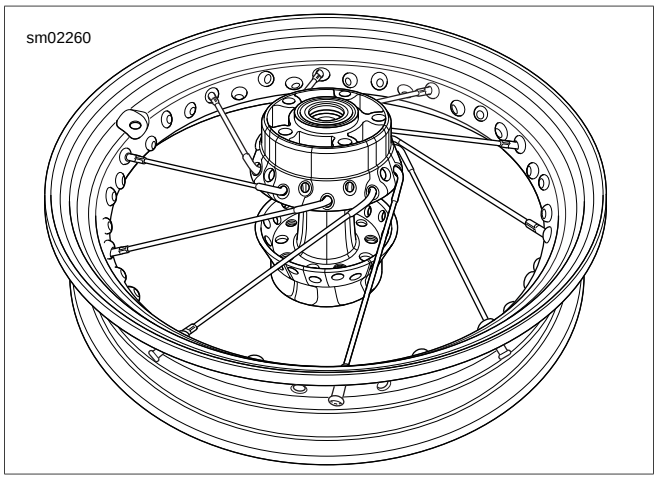


Figure 2-17. Brake Side Up: Bottom Row of Spokes Laced

5. See Figure 2-18. Place first **upper** row spoke into hub as shown. Angle spoke counterclockwise, **crossing four lower row spokes**. Spoke must enter hole to left of valve stem hole.

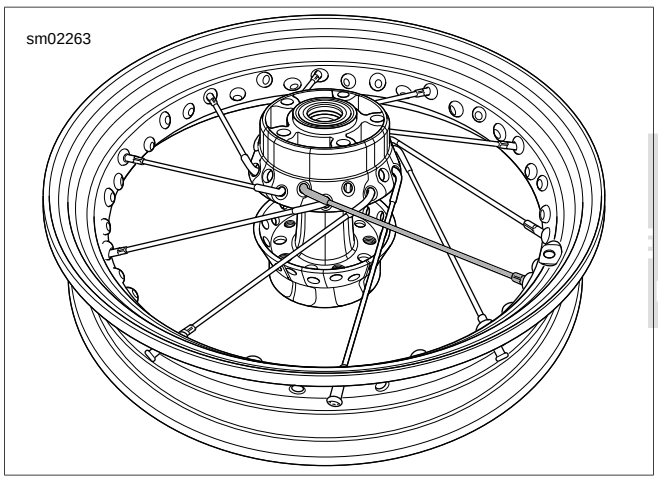


Figure 2-18. Brake Side Up: Start First Spoke of Top Row

6. See Figure 2-19. Install remaining nine upper row spokes, one into every fourth remaining hole above rim centerline. This completes spoke installation on one side.

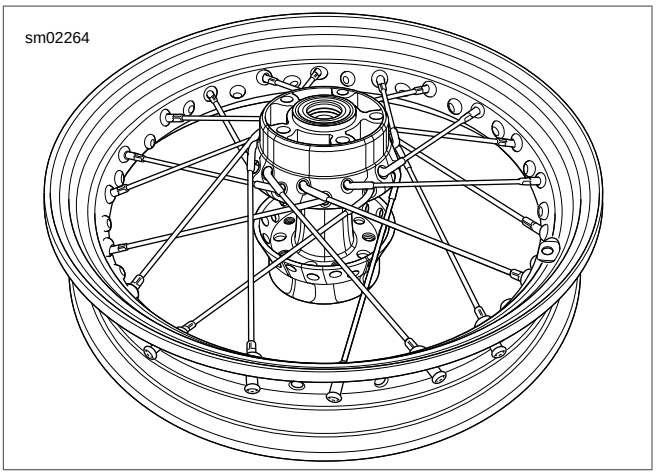


Figure 2-19. Brake Side Up: Top Row of Spokes Laced

7. See Figure 2-20. Turn wheel assembly over. Place any **lower** row spoke into hub. Angle spoke clockwise and place into rim hole angled to accept it.

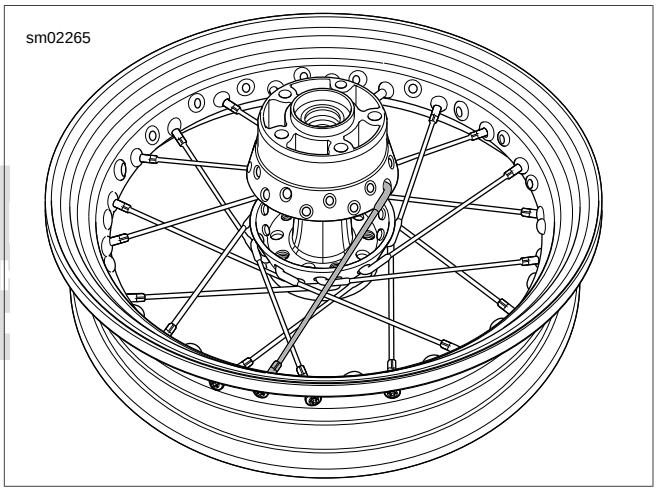


Figure 2-20. Sprocket Side Up: Start First Spoke of Bottom Row

8. See Figure 2-21. Place remaining nine lower row spokes, angled clockwise, into hub and rim.

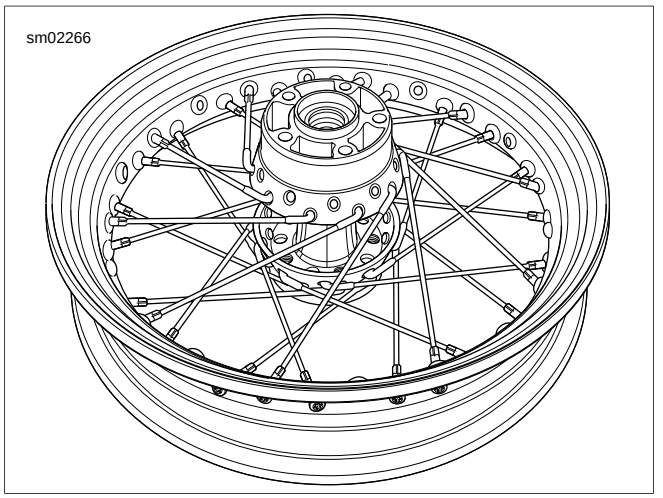


Figure 2-21. Sprocket Side Up: Bottom Row of Spokes Laced

9. See Figure 2-22. Insert any **upper** row spoke into hub and angle spoke counterclockwise. Place spoke into appropriate rim hole.

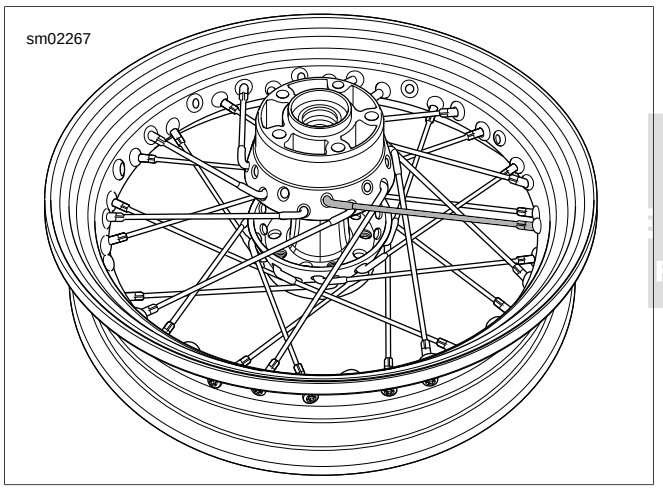


Figure 2-22. Sprocket Side Up: Start First Spoke of Top Row

10. See Figure 2-23. Install remaining nine upper row spokes into hub and rim.

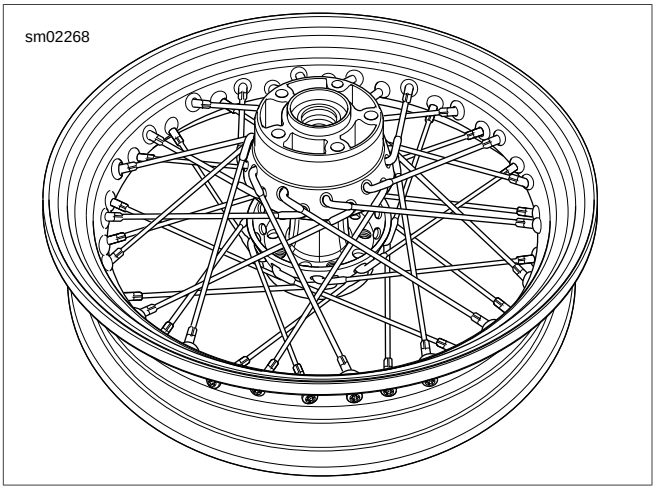


Figure 2-23. Wheel Completely Laced

11. Tighten spoke nipples to specification listed in Table 2-12.
12. True wheel. See 2.12 TRUING LACED WHEELS.

Table 2-12. Spoke Nipple Torque Specification

RIM TYPE	MINIMUM TORQUE
All	55 **in-lbs** (6.2 Nm)

SPOKE TIGHTNESS

See 1.10 TIRES AND WHEELS.

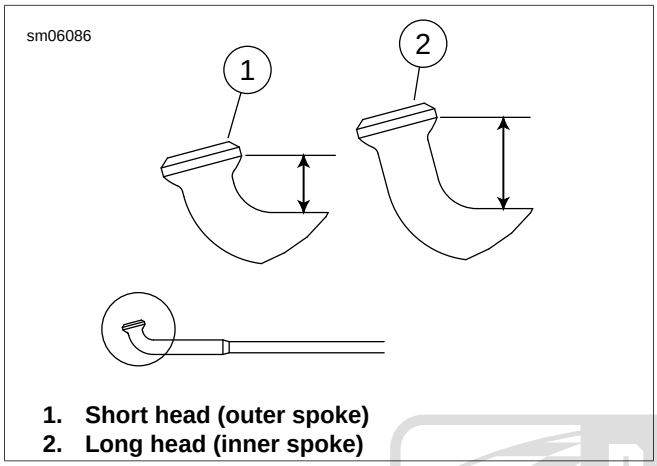
WHEEL LACING: 16 INCH REAR RIM 2.9

PROCEDURE

1. See Figure 2-24. Divide spokes into two groups.
 a. Outer spokes (short heads) (1).
 b. Inner spokes (long heads) (2).

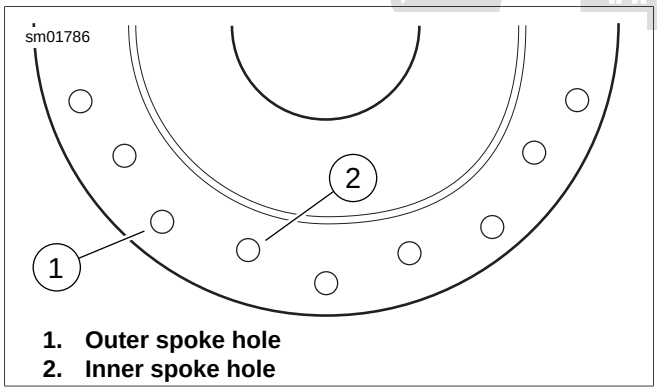
NOTE

See Figure 2-25. The spoke holes in the wheel hub are staggered, alternating between inner holes (2) (nearer hub center) and outer holes (1) (nearer hub edge).



1. **Short head (outer spoke)**
2. **Long head (inner spoke)**

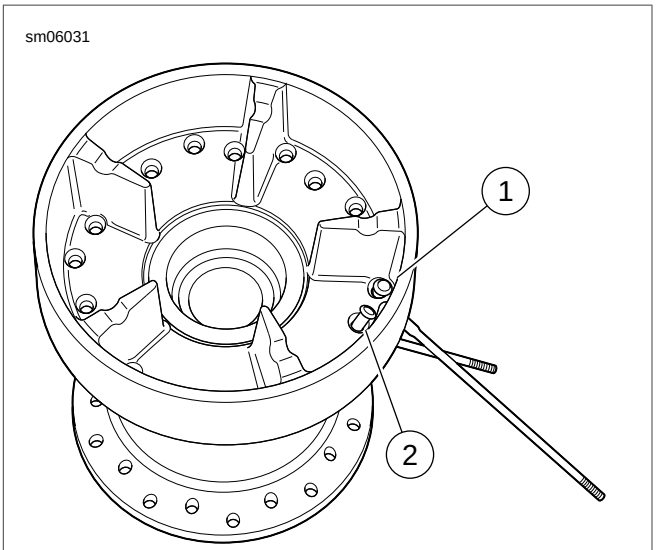
Figure 2-24. Spoke Heads



1. **Outer spoke hole**
2. **Inner spoke hole**

Figure 2-25. Spoke Hole Pattern

2. Lubricate spoke threads and nipple shoulders with tire mounting lubricant.
3. See Figure 2-26. Place hub on bench with the brake disc side down. Insert outer spokes (1) (short-head) into the outer holes and inner spokes (2) (long-head) in the inner holes.
4. See Figure 2-27. After spokes are installed, flip wheel hub over. Swing outer spokes counterclockwise and inner spokes clockwise as shown. Each inner spoke should cross four outer spokes, and each outer spoke should cross four inner spokes.
5. Install all outer spokes, then all inner spokes on brake-side flange. Swing inner spokes counterclockwise and outer spokes clockwise on brake-side flange, each crossing four of the opposite type.



1. **Outer spoke (short head)**
2. **Inner spoke (long head)**

Figure 2-26. Lacing Wheel Hub

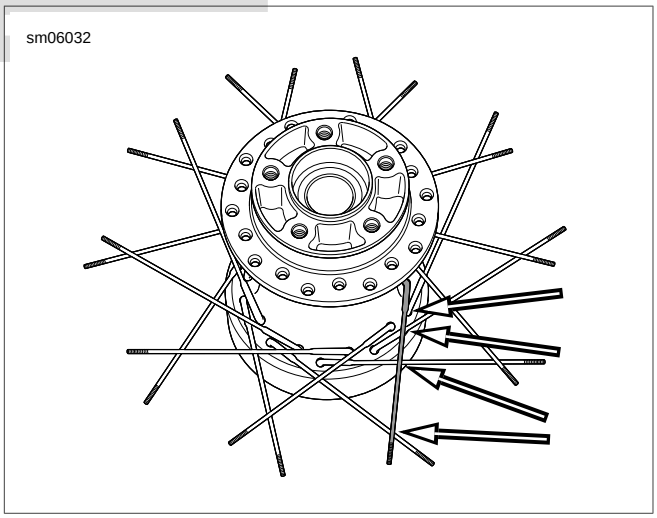


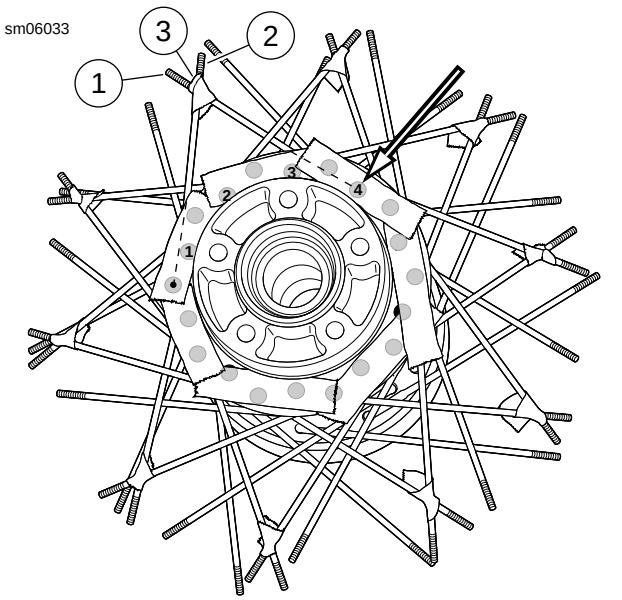
Figure 2-27. Arrange Spokes

NOTE

See Figure 2-28. Tape placed across brake disk flange and spoke heads will hold spokes up away from lower row of spokes, making it easier to gather upper spokes.

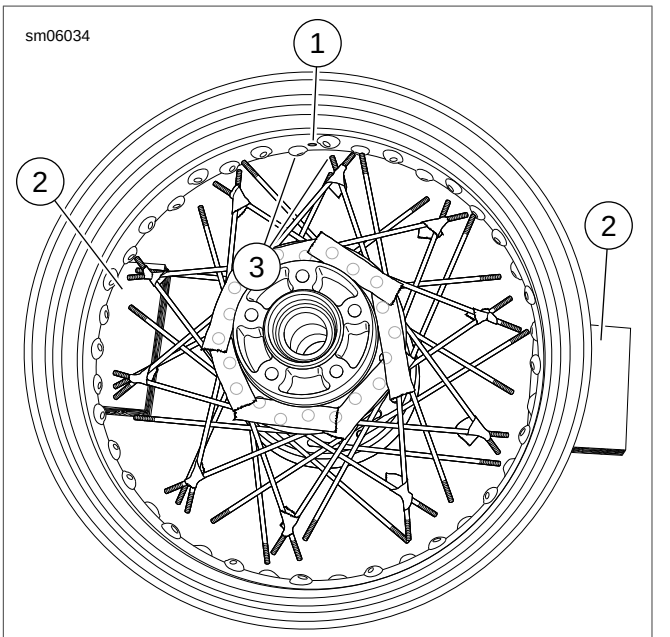
6. See Figure 2-28. Group upper spokes (brake-side) into bundles of two as shown. Join an outer spoke (1) with the inner spoke (2) that is located four places clockwise and

secure with tape (3) approximately 1 in. (25 mm) from threaded end.



1. **Outer spoke (short head)**
2. **Inner spoke (long head)**
3. **Tape**

Figure 2-28. Bundling Spokes



1. **Valve stem location**
2. **Wooden blocks**
3. **Beginning spoke location**

Figure 2-29. Place Rim

7. Make sure all spokes on compensator-side flange are still arranged properly and pointing in the correct direction:
 a. All outer spokes (short-head) point counterclockwise, crossing four inner spokes.
 b. All inner spokes (long-head) point clockwise, crossing four outer spokes (short-head).
 c. Angle all spokes as far as they will go without overlapping the next LIKE spoke.

NOTES

- *Verify all inner spokes lay inboard and outer spokes lay outboard.*
- *See Figure 2-29. The valve stem hole (1) is centered on the rim so rim orientation is not important.*

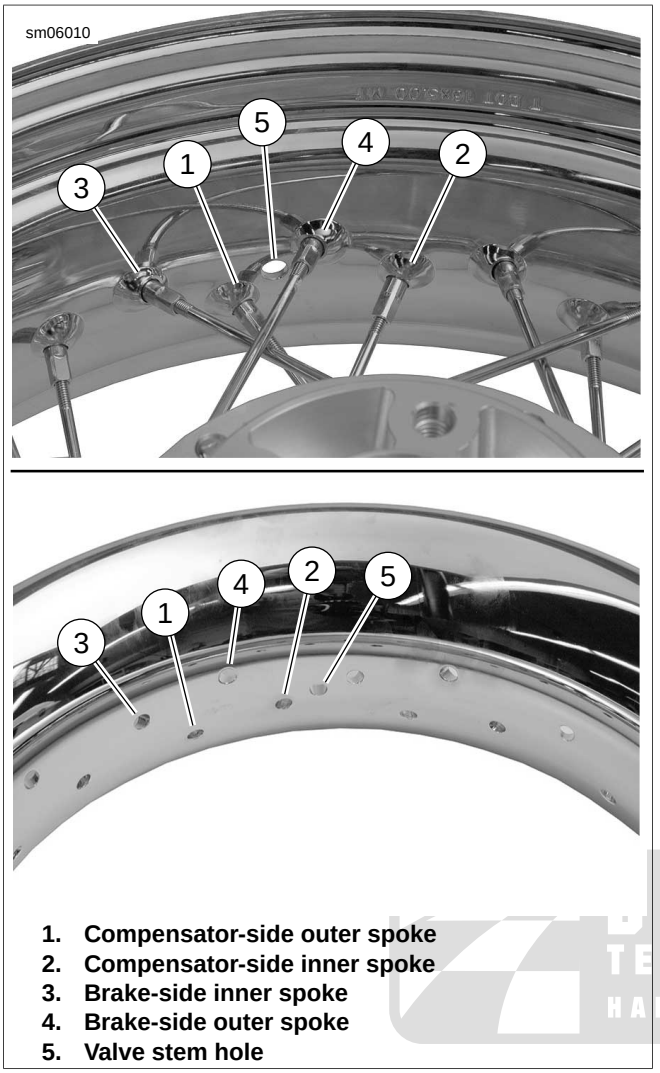
8. See Figure 2-29. Center the rim over the hub/spoke assembly and support on pieces of 2 x 4 lumber (2). Rotate so valve stem hole (1) is near a pair of taped spokes.

NOTE

See Figure 2-30. It is recommended that the first spoke be installed near the valve stem hole (5). Place spoke nipples through several rim holes to determine the hole direction. Only one spoke will fit into the spoke nipple correctly. When connecting the spoke to the spoke nipple, finger tighten two to three threads.

9. See Figure 2-30. Begin with the outer spokes (short-head) of the lower (compensator) flange. Using the spoke alignment method discussed previously, locate a spoke hole (1) just left of the valve stem hole (5) that points toward an outer spoke.
 a. Secure spoke to nipple. Skip three rim holes and repeat with the next outer spoke. Follow pattern to complete lower (compensator) flange outer spokes (short-head).
 b. Once completed, check for three empty holes between each spoke.

10. Install the lower (compensator) flange inner spokes (long-head) next. Choose a beginning spoke (2) near the valve stem hole (5).
 a. Each inner spoke (long-head) points clockwise and crosses four outer spokes (short-head).
 b. Secure spoke to nipple. Complete installing lower flange inner spokes (long-head).



1. **Compensator-side outer spoke**
2. **Compensator-side inner spoke**
3. **Brake-side inner spoke**
4. **Brake-side outer spoke**
5. **Valve stem hole**

Figure 2-30. Begin Lacing

NOTE

Use care not to move outer spokes (short-head) under inner spokes (long-head) when removing the tape or they will become trapped underneath the inner row of spokes.

11. See Figure 2-29. Remove tape from each upper bundle and fan the spokes out toward the rim.

NOTE

All upper flange inner spokes (long-head) should point counter-clockwise and outer spokes (long-head) clockwise.

12. See Figure 2-30. Choose a beginning spoke near the valve stem hole (5). Start with a top flange inner spoke (3) (long-head) first.
 a. Secure spoke to nipple. Follow pattern to complete upper (brake-side) flange inner spokes (long-head).
 b. Once completed, check for one empty hole after every third spoke.
13. Install upper flange outer spoke (4) (short-head).
14. Secure spoke to nipple. Complete upper flange outer spokes (short-head).

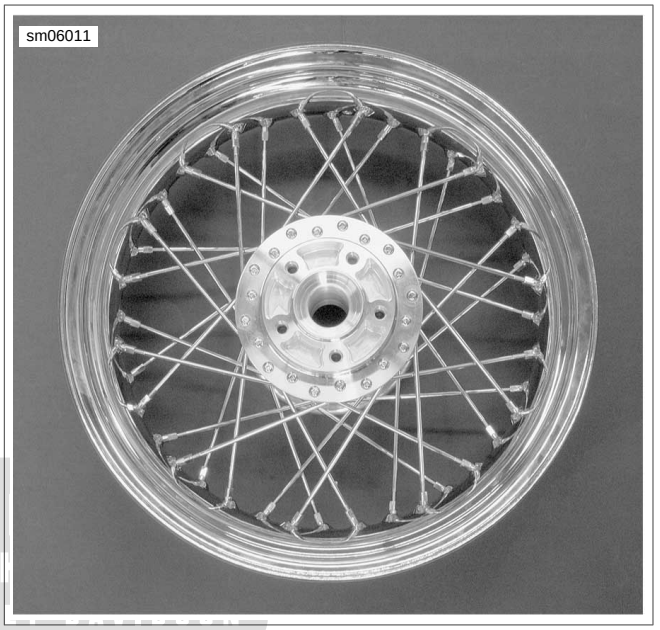


Figure 2-31. Completed 16 Inch Rear Wheel

15. Verify that completed wheel resembles Figure 2-31.
16. Work back and forth across wheel and evenly tighten spoke nipples to specification listed in Table 2-13.
17. True the wheel. See 2.12 TRUING LACED WHEELS.

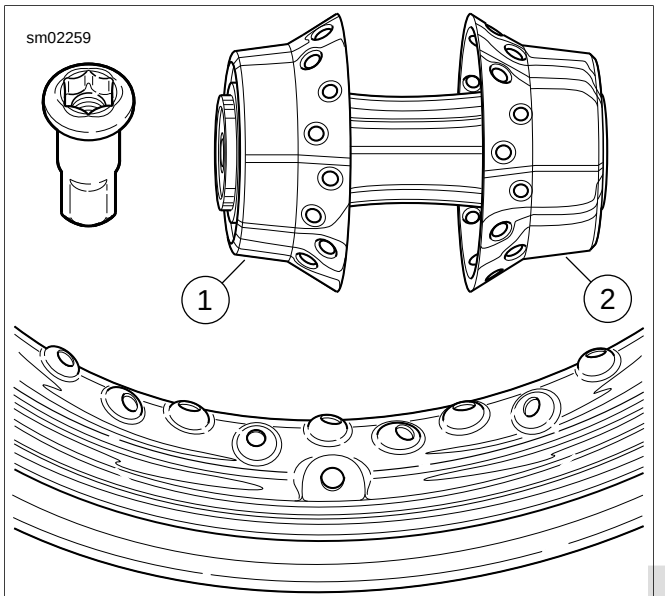
Table 2-13. Spoke Nipple Torque Specification

RIM TYPE	MINIMUM TORQUE
All	55 **in-lbs** (6.2 Nm)

WHEEL LACING: 17 INCH RIM 2.10

GENERAL

If only rim is to be replaced, tape spokes together to hold position on hub and remove spokes from rim. Install taped hub/spoke assembly to new rim and tighten spokes. Then remove tape and true wheels.



1. **Narrow flange (brake side)**
2. **Wide flange (sprocket side)**

Figure 2-32. Rim, Hub and Spoke Nipple

PROCEDURE

NOTE

The primary brake disc side of the hub can be identified by having one or two grooves cut into the disc mounting surface.

1. See Figure 2-33. Place the hub on table with primary brake disc side up. Insert a spoke in each hole of the **lower** row. Angle spokes clockwise.
2. Center the rim over the hub assembly with the valve stem hole facing upward.
3. See Figure 2-34. Using any **lower** row spoke, place the first spoke into the rim hole to the left of the valve stem hole on the upper half of the rim centerline.
4. See Figure 2-35. Install the rest of lower row spokes in every fourth hole.
5. See Figure 2-36. Place the first **upper** row spoke into the hub as shown below. Angle the spoke counterclockwise crossing four lower row spokes. The spoke must enter the hole to the left of the valve stem hole.
6. See Figure 2-37. Install the remaining nine upper row spokes into every fourth remaining hole above the rim centerline.

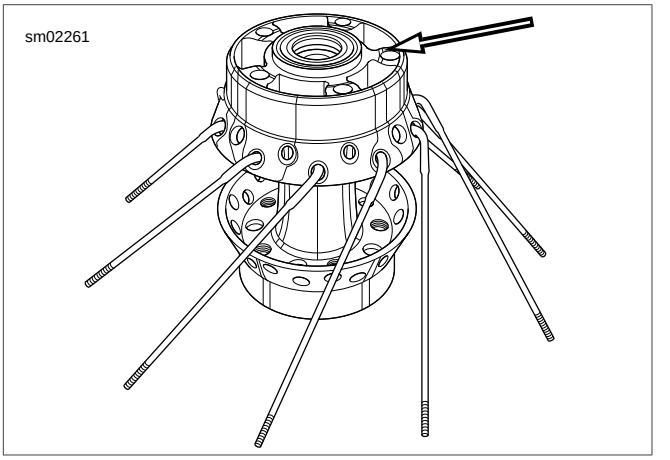


Figure 2-33. Hub: Primary Brake Disc Side Up

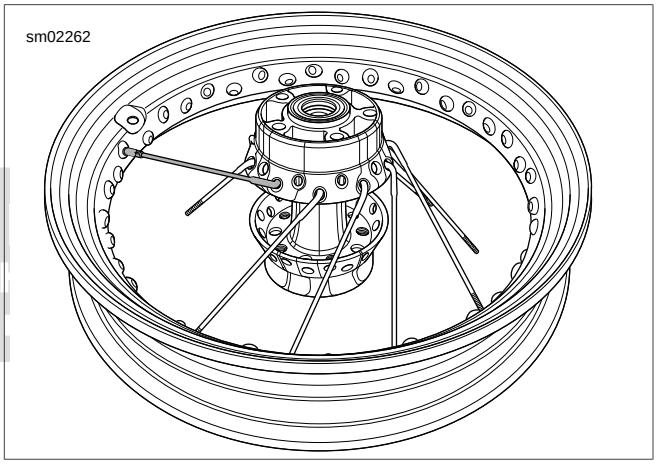


Figure 2-34. Brake Side Up: Start First Spoke of Bottom Row

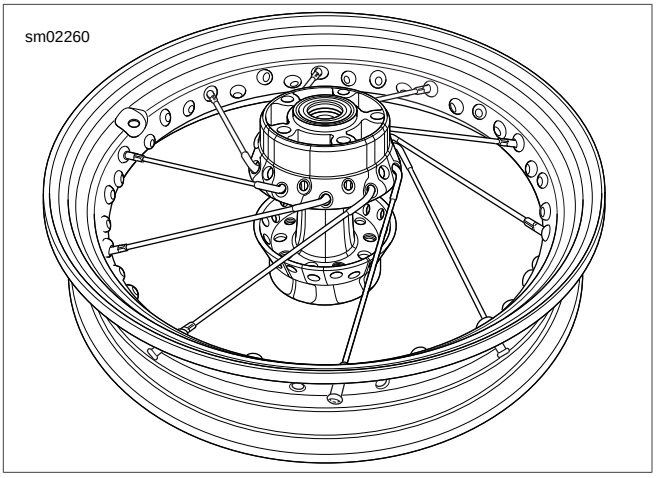


Figure 2-35. Brake Side Up: Bottom Row of Spokes Laced

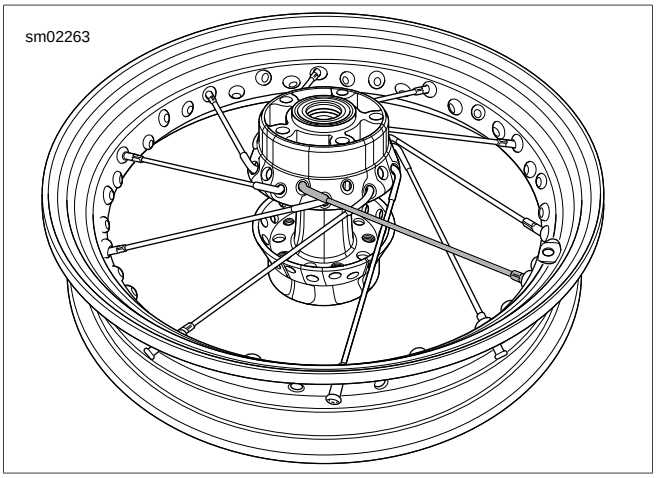


Figure 2-36. Brake Side Up: Start First Spoke of Top Row

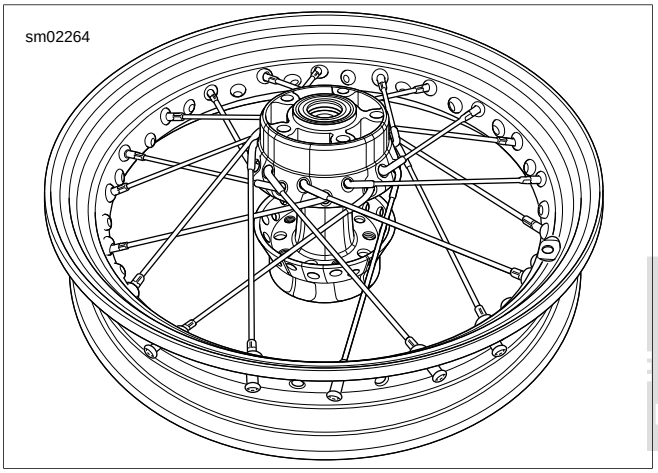


Figure 2-37. Brake Side Up: Top Row of Spokes Laced

7. See Figure 2-38. Turn hub and rim over so the primary brake disc side faces down. Place any **lower** row spoke into hub. Angle spoke clockwise and place into rim hole angled to accept it.
8. See Figure 2-39. Place the remaining nine lower row spokes, angled clockwise, into hub and rim.
9. See Figure 2-40. Insert any **upper** row spoke into hub and angle spoke counterclockwise. Place spoke into appropriate rim hole.
10. See Figure 2-41. Install remaining nine upper row spokes.
11. Tighten spoke nipples to specification listed in Table 2-14.
12. True wheel. See 2.12 TRUING LACED WHEELS.

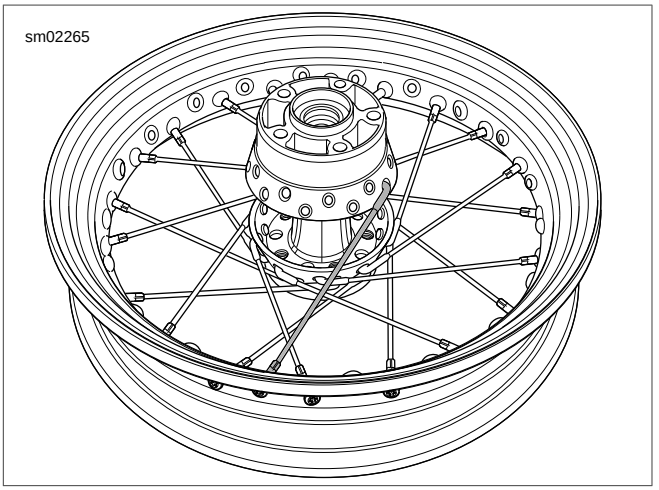


Figure 2-38. Sprocket Side Up: Start First Spoke of Bottom Row

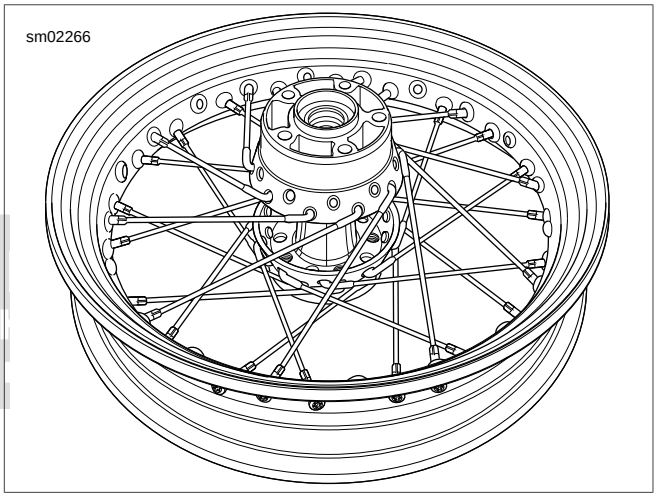


Figure 2-39. Sprocket Side Up: Bottom Row of Spokes Laced

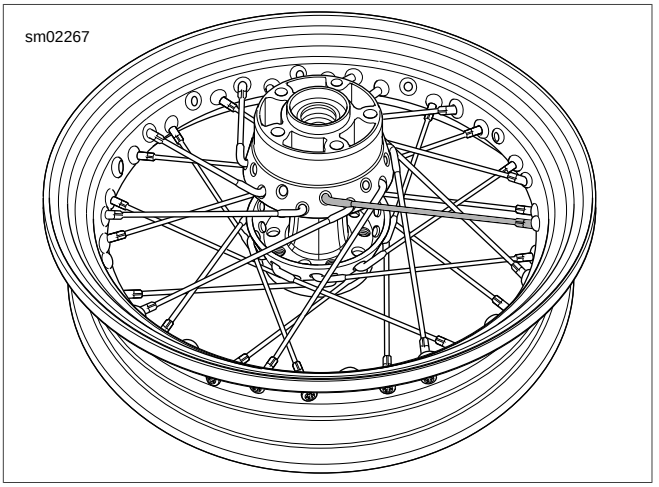


Figure 2-40. Sprocket Side Up: Start First Spoke of Top Row

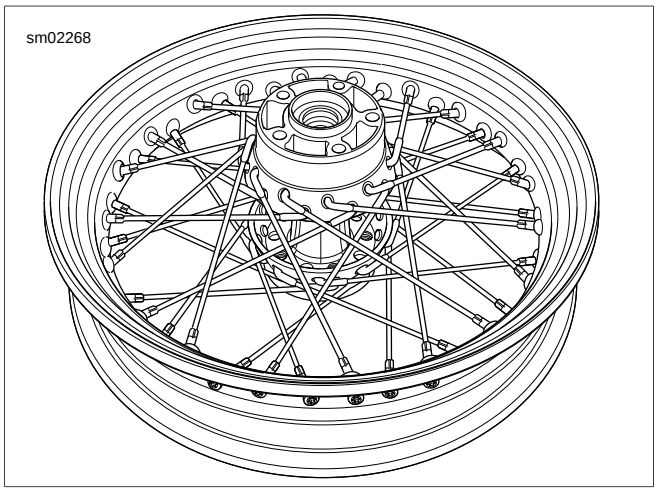


Figure 2-41. Wheel Completely Laced

Table 2-14. Spoke Nipple Torque Specification

RIM TYPE	MINIMUM TORQUE
All	55 **in-lbs** (6.2 Nm)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

SEALED WHEEL BEARINGS 2.11

INSPECTION

1. Turn the wheel through several rotations.

NOTE

If ABS equipped, keep magnetic base dial indicator as far away from wheel speed sensor and ABS encoder bearing as possible, or damage will occur.

2. Check end play as follows:
 a. See Figure 2-42. Mount a magnetic base dial indicator to the brake disc. Set the indicator contact point on the end of the axle.
 b. Firmly push the wheel to one side and zero the dial indicator gauge.
 c. Firmly pull the wheel back as far as it will go and note the reading of the dial indicator.
 d. Repeat the procedure to verify the reading.
 e. Bearings pass end play inspection if the reading is less than 0.002 in. (0.051 mm).
 f. Replace the bearings if end play exceeds specification, or if there is drag, rough rotation, abnormal noise or anything unusual.

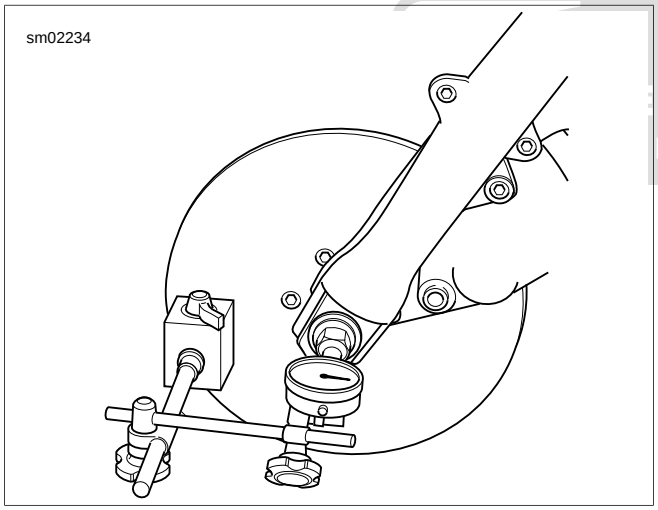
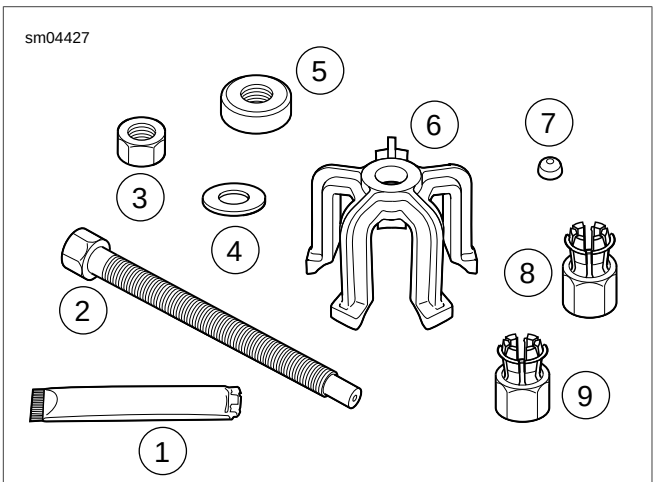


Figure 2-42. Wheel Bearing Inspection (Front Wheel Shown)

REMOVAL

PART NUMBER	TOOL NAME
HD-44060B	WHEEL BEARING REMOVER/INSTALLER

1. Remove wheel. See 2.4 FRONT WHEEL or 2.5 REAR WHEEL.



1. **Graphite lubricant**
2. **Forcing screw**
3. **Hex nut**
4. **Flat washer**
5. **Nice bearing**
6. **Bridge**
7. **Steel ball**
8. **Standard 25mm collet**
9. **ABS 25mm collet**

Figure 2-43. Wheel Bearing Remover Tools (HD-44060B)

Table 2-15. Primary Brake Disc Side

WHEEL	SIDE	VISUAL CUE
FRONT	LEFT	Side Opposite Valve Stem
REAR	RIGHT	Valve Stem Side

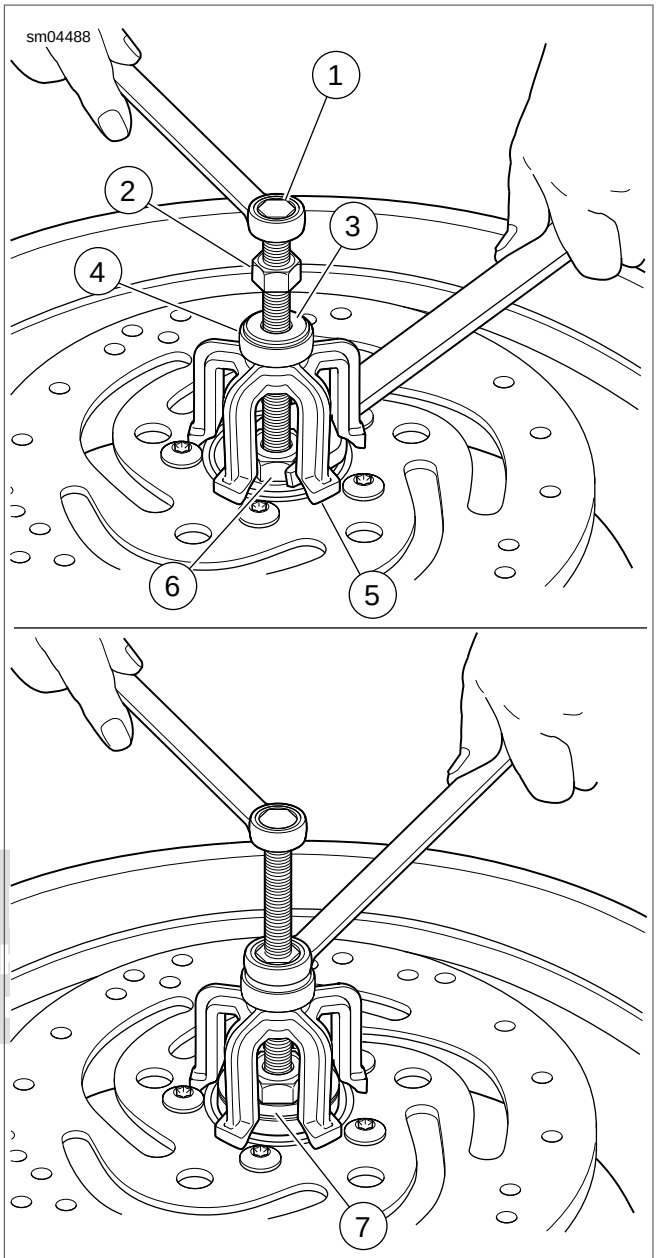
2. If servicing rear wheel, remove compensator sprocket.
3. See Figure 2-43. Obtain the WHEEL BEARING REMOVER/INSTALLER (Part No. HD-44060B).
4. Sparingly apply graphite lubricant to threads of forcing screw.
5. Install hex nut, flat washer and Nice bearing on forcing screw. Insert end of forcing screw through hole in bridge.

NOTES

- *Always remove the bearing from the primary brake disc side of the wheel first. Position wheel accordingly. Refer to Table 2-15.*
- *As ABS equipped motorcycles use both a special encoder bearing and a standard bearing in the same hub, two different 25 mm collets are required for bearing removal. The ABS encoder bearing is always installed on the primary brake disc side of the wheel. To aid in identification, the outboard side of the ABS encoder bearing is greenish tan in color, while the standard bearing is black.*

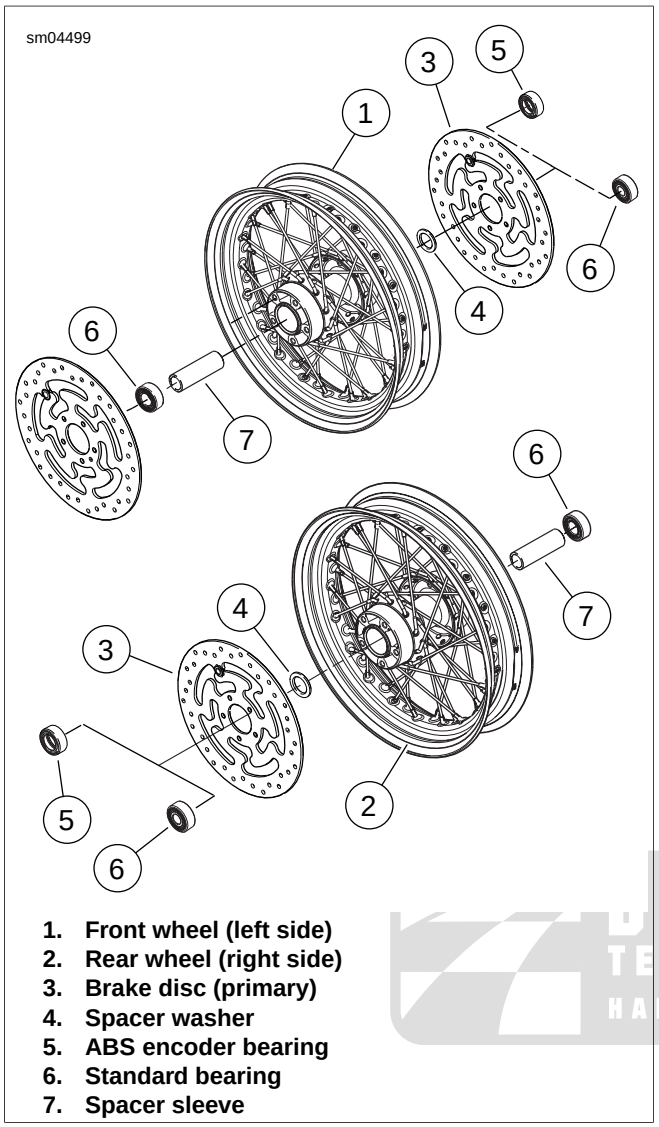
6. Select the appropriate 25 mm collet. Select HD-44060-11 if the motorcycle is ABS equipped, or HD-44060-10 for non-ABS equipped motorcycles.

7. Place steel ball inside collet. Install collet at end of forcing screw.
8. Insert collet into bearing ID. Feel for inside edge of bearing using lip at end of collet and then back off slightly.
9. See upper frame of Figure 2-44. Hold hex on forcing screw (1) and turn hex on collet (6) until lip makes firm contact with inside edge of bearing.
10. See Figure 2-44. Turn hex nut (2) until bearing is free. Discard bearing.
11. See Figure 2-45. Remove spacer washer (4) and spacer sleeve (7) from hub.
12. If ABS encoder bearing was removed from primary brake disc side of wheel, remove ABS collet from forcing screw and install standard collet.
13. Repeat applicable steps to remove standard bearing from opposite side of wheel, using the appropriate collet. Discard bearing.



1. **Forcing screw**
2. **Hex nut**
3. **Flat washer**
4. **Nice bearing**
5. **Bridge**
6. **25mm collet**
7. **Wheel bearing**

Figure 2-44. Remove Wheel Bearings



1. **Front wheel (left side)**
2. **Rear wheel (right side)**
3. **Brake disc (primary)**
4. **Spacer washer**
5. **ABS encoder bearing**
6. **Standard bearing**
7. **Spacer sleeve**

Figure 2-45. Wheel Bearing Assemblies

INSTALLATION

PART NUMBER	TOOL NAME
HD-44060B	WHEEL BEARING REMOVER/INSTALLER

NOTES

- *Always keep ABS encoder bearings away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur.*
- *Always replace bearings as a complete set. Never replace just one bearing.*

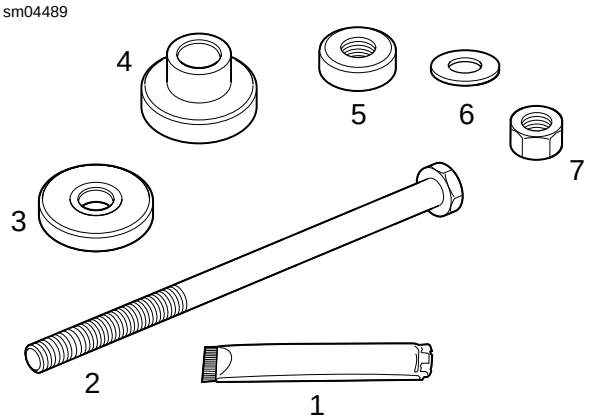
1. Obtain WHEEL BEARING REMOVER/INSTALLER (Part No. HD-44060B). Proceed as follows:
 a. Sparingly apply graphite lubricant to threads of rod.
 b. Install support plate onto rod.

 NOTE
 Always install the bearing on the primary brake disc side of the wheel first. Refer to Table 2-15. On ABS equipped motorcycles, the special encoder bearing is always installed at this location.

 c. Slide rod through hub.
 d. Slide spacer washer down rod until seated on counterbore in hub.

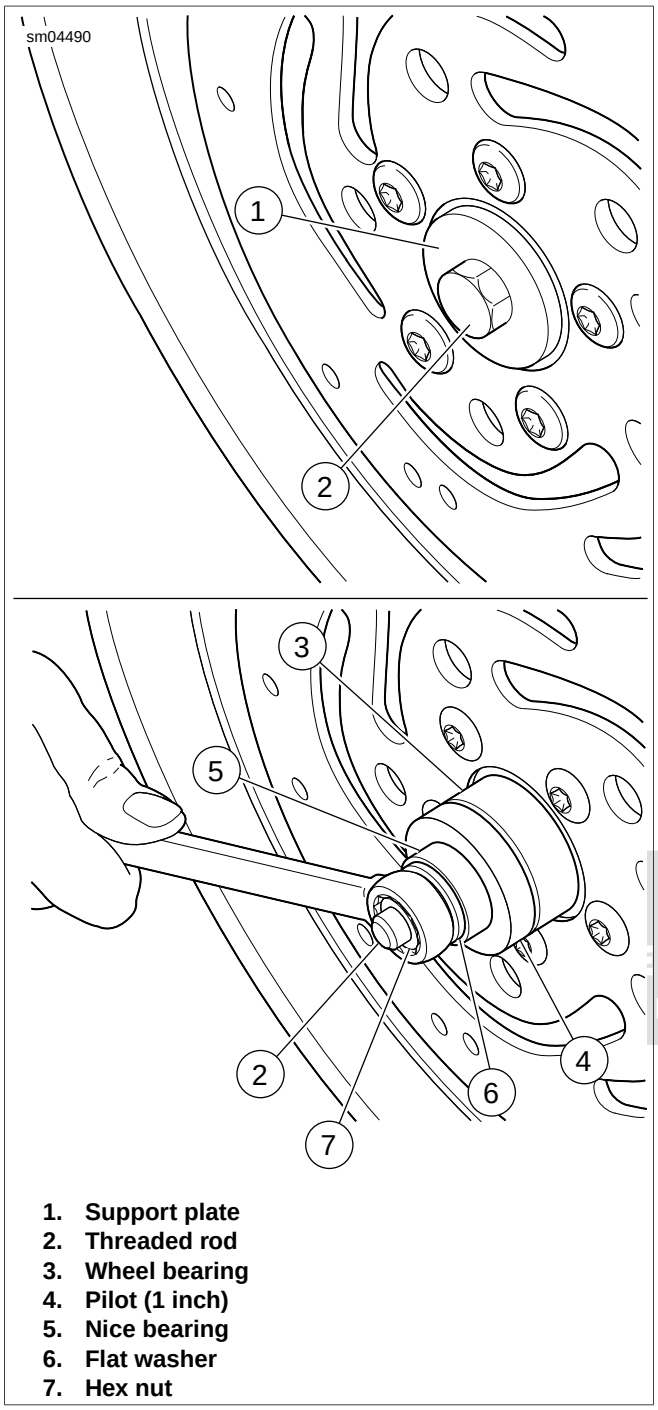
 NOTE
 Bearing orientation is important.

 e. If ABS equipped, slide encoder bearing down rod oriented with the red side in and the greenish tan side out. If not ABS equipped, install standard bearing on rod with the lettered side out.
 f. Install 1 inch pilot, Nice bearing, flat washer and hex nut onto rod.
2. See upper and lower frames of Figure 2-47. Hold hex on rod and turn hex nut to install bearing. Bearing is fully seated when it makes firm contact with spacer washer.
3. Reverse tool and install opposite side bearing until bearing contacts inner spacer.
4. Install wheel. See 2.4 FRONT WHEEL or 2.5 REAR WHEEL.



1. **Graphite lubricant**
2. **Threaded rod**
3. **Support plate**
4. **Pilot (1 inch)**
5. **Nice bearing**
6. **Flat washer**
7. **Hex nut**

Figure 2-46. Wheel Bearing Installer Tools (HD-44060B)



1. **Support plate**
2. **Threaded rod**
3. **Wheel bearing**
4. **Pilot (1 inch)**
5. **Nice bearing**
6. **Flat washer**
7. **Hex nut**

Figure 2-47. Install Wheel Bearings

IGITAL
CHNICIAN® II
RLEY-DAVIDSON®

TRUING LACED WHEELS 2.12

GENERAL

The rim must be trued both laterally and radially. If **new** bearings were installed, wheels may be trued with only the bearings and center spacer installed.

LATERAL TRUING

PART NUMBER	TOOL NAME
HD-94681-80	SPOKE WRENCH
HD-99500-80	WHEEL TRUING STAND

1. Divide the wheel spokes into ten groups of four and mark the center of each group with a piece of tape. The groups should be directly across from one another and approximately 90 degrees apart. Tighten the spokes in these four groups finger tight.
2. See Figure 2-48. Install truing arbor in wheel hub and place wheel in WHEEL TRUING STAND (Part No. HD-99500-80). Tighten arbor nuts so hub will turn on its bearings.

NOTE

The primary brake disc side of the hub can be identified by having one or two grooves cut into the disc mounting surface.

3. Lay a straightedge across primary brake disc mounting surface of hub and one of the marked spoke groups.
4. See Figure 2-49 and Table 2-16. Measure distance "A" from the straightedge to the location as shown.

NOTES

- *Tighten or loosen spoke, one flat at a time, and recheck measurement.*
- *Always loosen the appropriate spokes before tightening the other two. Reversing this procedure will cause the rim to become out-of-round.*

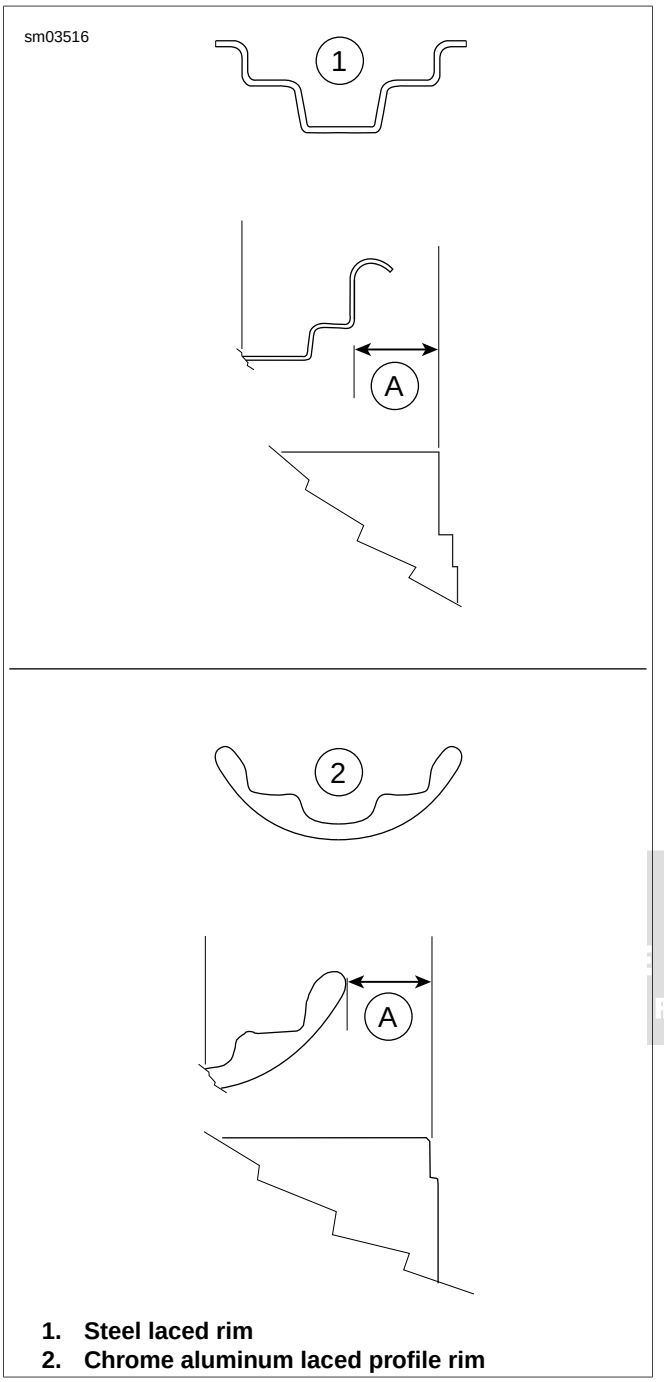
5. If the dimension is not correct, tighten the four spokes accordingly. Use SPOKE WRENCH (Part No. HD-94681-80). For example, If the measurement on the **right** rim edge side is **less** than it should be, **loosen** the two spokes attached to the hub **right** side and **tighten** the two spokes attached to the hub **left** side. Turn all four spokes an equal number of turns until offset dimension is correct.
6. Repeat the previous step for all ten groups on the wheel.



Figure 2-48. Front Wheel Hub Offset Dimension

Table 2-16. Offset Dimensions

Rim Type	Rim Size	OFFSET (A)	
		IN.	MM.
Steel Laced (1)			
Front	16 x 3	1.551-1.571	39.4-39.9
Rear	16 x 5	1.098-1.118	27.9-28.4
Chrome Aluminum Laced Profile (2)			
Front	16 x 3	1.267-1.287	32.19-32.69
Front	17 x 3	1.267-1.287	32.19-32.69
Rear	16 x 5	0.831-0.850	21.1-21.6



1. **Steel laced rim**
2. **Chrome aluminum laced profile rim**

Figure 2-49. Laced Hub Offset Dimensions

RADIAL TRUING

1. See Figure 2-50. Adjust truing stand gauge to the rim's tire bead seat as shown. The rim should be trued within 0.030 in. (0.76 mm).

NOTES

- *Tighten or loosen spoke one flat at a time and recheck measurement.*
- *Always loosen the appropriate spokes before tightening the other two. Reversing this procedure will cause the rim to become out-of-round.*

2. Spin the rim slowly.
 a. If the rim contacts the gauge on or near a marked group of spokes, loosen the spokes in the marked group on the opposite side of the rim. Now tighten the spokes in the group where the rim makes contact. Loosen and tighten spokes an equal number of turns.
 b. If the rim contacts the gauge between two marked groups, loosen the spokes in both opposite groups and tighten the spoke groups on the side of the rim that makes contact.
3. When the wheel is centered and trued, start at the valve hole and tighten the rest of the spoke nipples one turn at a time until they are snug.
4. Seat each spoke head in the hub flange using a flat nose punch and mallet. Then check wheel trueness again and tighten the nipples accordingly.

⚠WARNING

Spokes that are too tight can draw nipples through the rim or distort hub flanges. Spokes that are too loose can continue to loosen when put in service. Either condition can adversely affect stability and handling, which could result in death or serious injury. (00286a)

5. Verify spokes are tightened to specification listed in Table 2-17.
6. File or grind off ends of spokes protruding through nipples to prevent puncturing tube when tire is mounted.

NOTE

After installation of front wheel, visually check the relationship of the front wheel to the fork fender bosses. The front wheel should be approximately centered between the bosses.

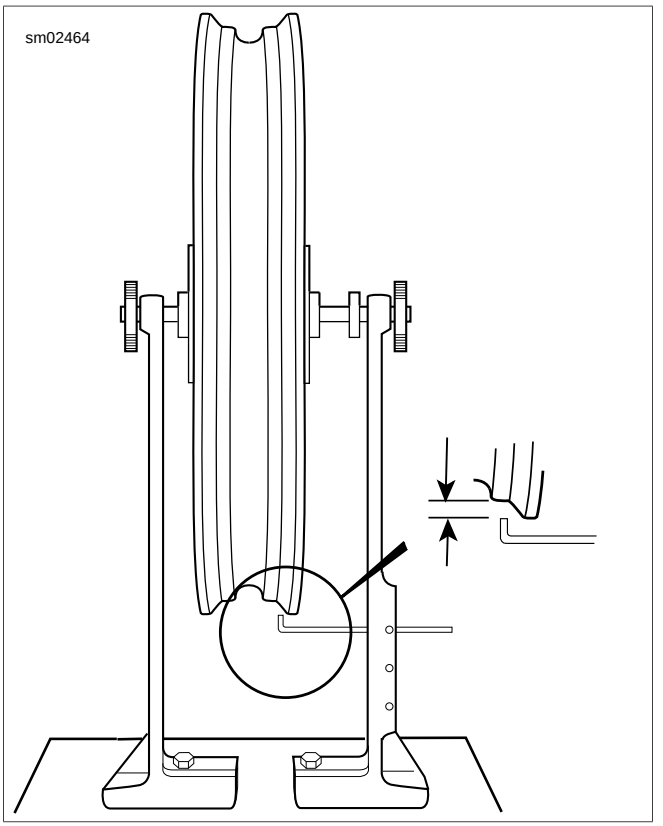


Figure 2-50. Truing Rim Radially

Table 2-17. Spoke Nipple Torque Specification

RIM TYPE	MINIMUM TORQUE
All	55 **in-lbs** (6.2 Nm)

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CHECKING CAST WHEEL RUNOUT 2.13

GENERAL

The die-cast wheels should be checked for lateral and radial runout before installing a new tire or tube.

LATERAL RUNOUT

See Figure 2-51. Install arbor in the wheel hub and place wheel in the truing stand. To check rim lateral runout, place a gauge rod or dial indicator near the rim bead. If lateral runout exceeds 0.030 in. (0.76 mm), replace the wheel.

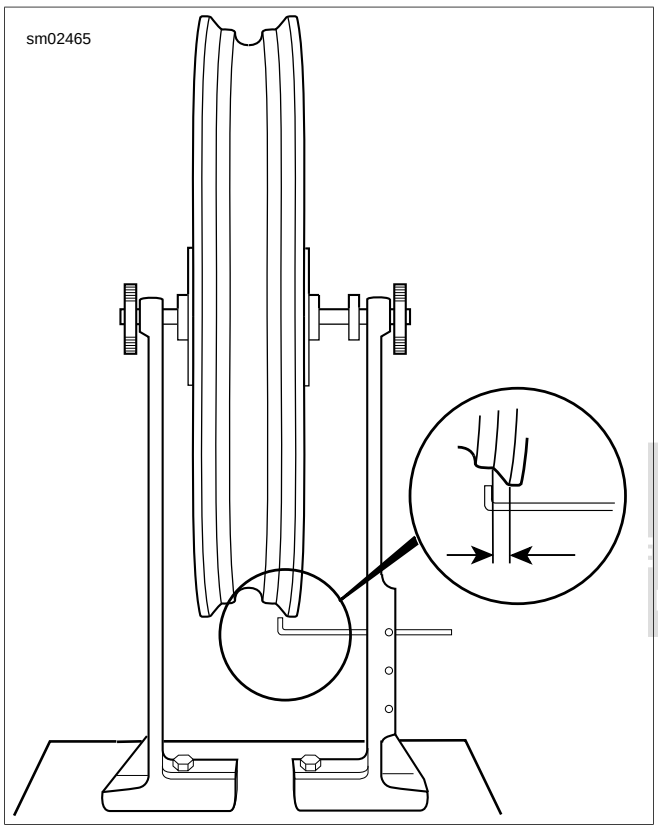
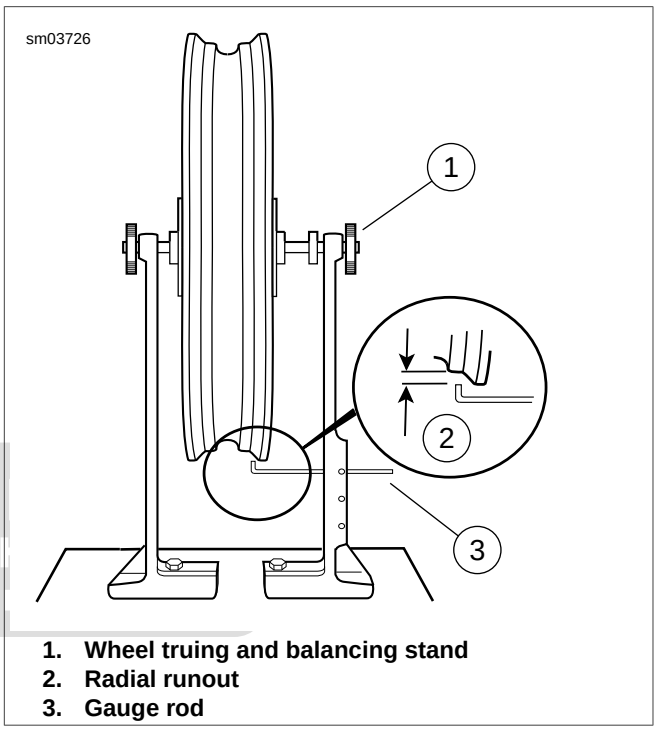


Figure 2-51. Checking Lateral Runout

RADIAL RUNOUT

PART NUMBER	TOOL NAME
HD-99500-80	WHEEL TRUING AND BALANCING STAND

See Figure 2-52. Using WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80), check for radial runout as shown. Replace the wheel if runout exceeds 0.030 in. (0.76 mm).



1. **Wheel truing and balancing stand**
2. **Radial runout**
3. **Gauge rod**

Figure 2-52. Checking Cast Wheel Radial Runout

FRONT BRAKE MASTER CYLINDER 2.14

GENERAL

CAUTION

Do not allow dirt or debris to enter the master cylinder reservoir. Dirt or debris in the reservoir can cause improper operation and equipment damage. (00205c)

CAUTION

Direct contact of D.O.T. 4 brake fluid with eyes can cause irritation. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts of D.O.T. 4 brake fluid can cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN. (00240a)

CAUTION

D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)

NOTE

Immediately wipe up any brake fluid spillage with a clean, dry, soft cloth. Follow up by thoroughly wiping affected area with a clean, damp, soft cloth (small spills) or washing with a large quantity of soapy water (large spills).

REMOVAL AND DISASSEMBLY

Removal

1. Turn front wheel toward the left fork stop until the master cylinder reservoir is level.
2. To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.
3. Remove cover from master cylinder reservoir.

NOTE

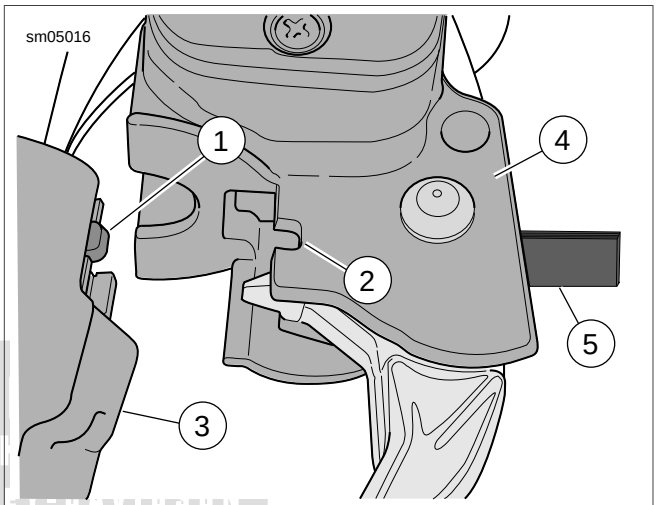
Wrap banjo fitting with piece of shop towel to absorb any loss of brake fluid.

4. Remove banjo bolt. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard copper washers.
5. Using a clean shop cloth, wipe out any remaining fluid in the master cylinder reservoir.

CAUTION

Do not remove or install the master cylinder assembly without first positioning a 5/32-inch (4 mm) thick insert between the brake lever and lever bracket. Removing or installing the master cylinder assembly without the insert in place may result in damage to the rubber boot and plunger on the front stoplight switch. (00324a)

6. Place cardboard insert between brake lever and lever bracket. Use the eyelet of a small cable strap if the cardboard insert is not available.
7. See Figure 2-53. Remove handlebar clamp from master cylinder reservoir. Remove clamp and master cylinder reservoir/brake lever assembly from handlebar.
8. Remove cardboard insert between brake lever and lever bracket.
9. Remove retaining ring from pivot pin groove at bottom of brake lever bracket. Discard retaining ring.
10. Remove pivot pin and brake lever from brake lever bracket.



1. **Tab**
2. **Groove**
3. **Switch housing assembly**
4. **Brake lever bracket**
5. **Cardboard insert**

Figure 2-53. Remove Master Cylinder/Brake Lever Assembly

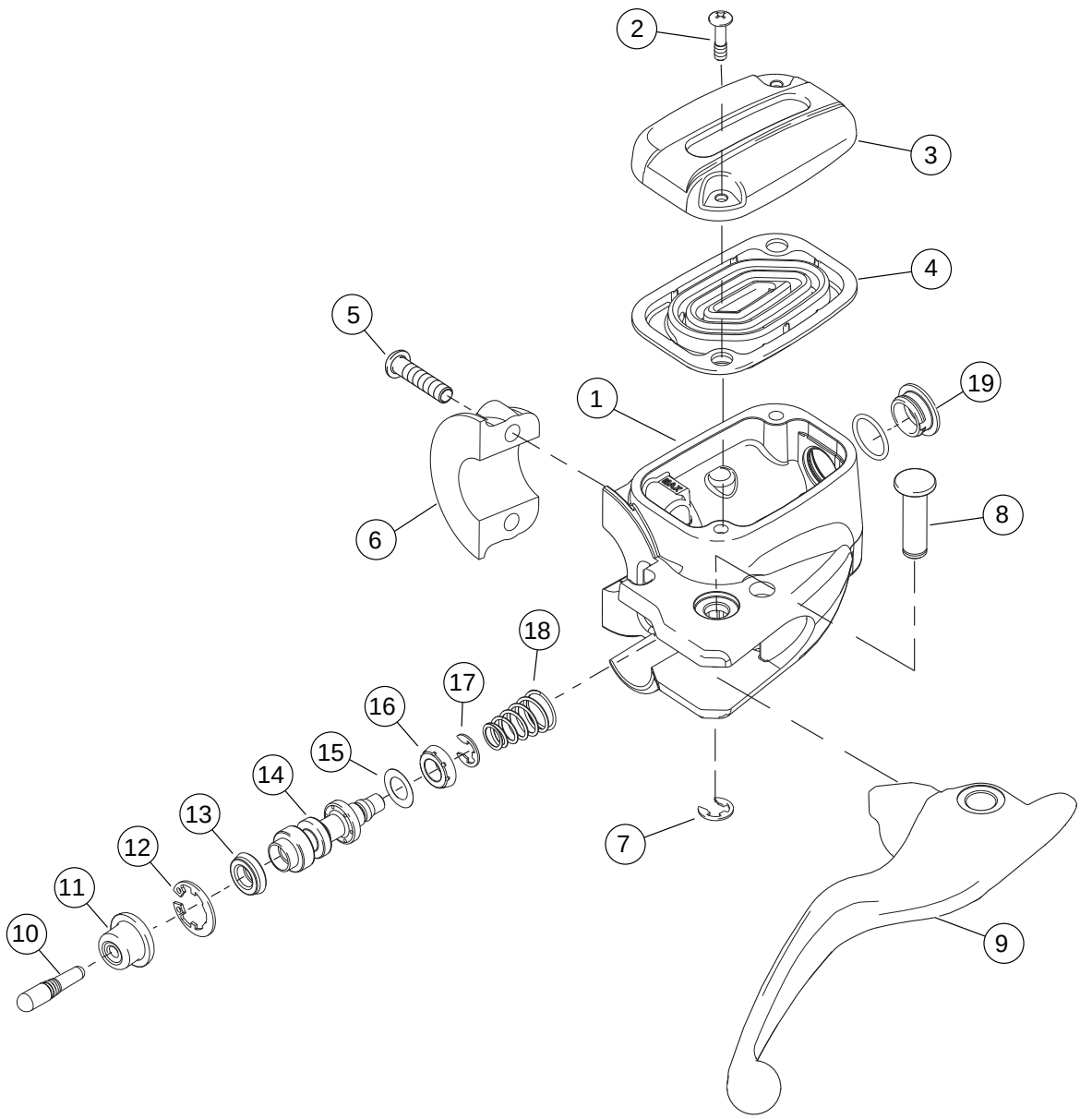
Disassembly

NOTE

Exercise care to avoid scratching or nicking banjo sealing surface during handling. Damage to the sealing surface requires replacement of the master cylinder reservoir.

1. See Figure 2-54. Pull dust boot (11) with pushrod (10) from piston bore. Remove dust boot from pushrod.
2. Hold pressure against piston (14) and remove retaining ring (12).
3. Pull piston assembly from piston bore.

sm05012



1. **Master cylinder reservoir**
2. **Cover screw (2)**
3. **Cover**
4. **Gasket**
5. **Clamp screw (2)**
6. **Handlebar clamp**
7. **Retaining ring**
8. **Pivot pin**
9. **Brake hand lever**
10. **Pushrod**
11. **Dust boot**
12. **Retaining ring**
13. **Secondary seal**
14. **Piston**
15. **Flat washer**
16. **Primary seal**
17. **E-clip**
18. **Spring**
19. **Sight glass/O-ring**

Figure 2-54. Front Brake Master Cylinder Assembly

NOTE

Piston and components (13-18) are serviced as an assembly only.

CLEANING AND INSPECTION

⚠WARNING

Use denatured alcohol to clean brake system components. Do not use mineral-based solvents (such as gasoline or paint thinner), which will deteriorate rubber parts even after assembly. Deterioration of these components can cause brake failure, which could result in death or serious injury. (00291a)

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

1. Clean all parts with denatured alcohol. Wipe dry with a clean, lint free cloth.
2. Inspect banjo seating surface for scratches or nicks.
3. Verify that reservoir is completely free of dust, dirt or residue.
4. Using a clean air supply, blow out piston bore and other drilled passages. Do not use a wire or similar instrument.
5. Inspect piston bore for scratches, nicks, scoring, pitting, corrosion or other damage.
6. Inspect retaining ring for wear or distortion. Inspect retaining ring groove for damage.
7. Inspect spring for stretching, distortion, kinks, cracks or broken coils.
8. Inspect piston seals, dust boot and reservoir cover gasket for cuts, tears or general deterioration.

ASSEMBLY AND INSTALLATION

Assembly

1. See Figure 2-54. Lightly lubricate piston bore and OD of piston seals with D.O.T. 4 brake fluid.
2. Insert spring end of piston assembly into piston bore.
3. While pushing on piston to compress spring, install retaining ring in groove of piston bore (with the flat side in). Verify that retaining ring is completely seated in groove.
4. Install dust boot onto pushrod, so that ID on tapered end engages groove in pushrod.
5. Install dust boot into piston bore, fitting ball end of pushrod into piston socket. Verify that collar on OD of dust boot is inboard of lip in piston bore.

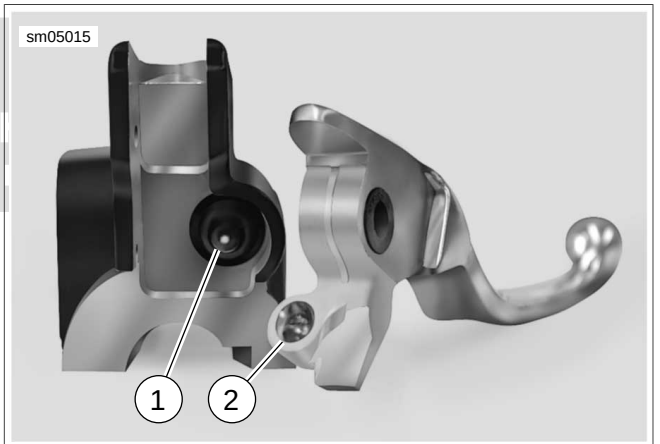
Installation

1. See Figure 2-55. Place dab of G-40M grease (HD Part No. 42820-04) into pocket of hand lever.
2. Install brake hand lever and secure with pivot pin.
3. Install **new** retaining ring in pivot pin groove. Verify that retaining ring is completely seated in groove.
4. Place cardboard insert between brake lever and brake lever bracket. Use the eyelet of an ordinary cable strap if the cardboard insert is not available.
5. See Figure 2-53. Position brake lever/master cylinder reservoir assembly, engaging tab (1) in groove (2) at top of brake lever bracket.
6. Install two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten screws to 72-84 **in-lbs** (8.1-9.5 Nm).
7. Secure brake line to master cylinder reservoir. Tighten banjo bolt to master cylinder to 13-15 ft-lbs (17.6-20.3 Nm).

⚠WARNING

Any time the ABS module, either master cylinder, or any line between a master cylinder and the ABS module is disconnected or replaced, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to do so could result in air in the hydraulic brake system, reducing brake efficiency, which could result in death or serious injury. (00585b)

8. Fill and bleed brake system. See 1.16 BLEEDING BRAKES.



1. **Pushrod**
2. **Lever pocket**

Figure 2-55. Apply Grease to Lever Pocket

FRONT BRAKE LINE - NON-ABS EQUIPPED

Removal

NOTE

For service of ABS equipped vehicles, see APPENDIX C ABS.

1. **FLHR/C:**
 a. Remove right side headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
 b. See Figure 2-56. Cut cable strap to release right handlebar switch conduit and brake hose from right handlebar riser.
 c. See Figure 2-57. Cut cable strap to release front fender tip lamp wires from left brake caliper hose.
2. **FLHX, FLHT/C/U:**
 a. Remove outer fairing and fairing cap. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 2.38 FAIRING CAP: FLHX, FLHT/C/U, respectively.
 b. Cut cable strap to release right handlebar switch conduit and brake line from right handlebar.
 c. See Figure 2-57. Cut cable strap to release front fender tip lamp wires from left brake caliper hose.
3. **FLTR:**
 a. Remove right side instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.
 b. If present, remove P-clip securing brake line to front right side of upper fork bracket.
4. Remove front brake line bracket from bottom of lower fork bracket.
5. Turn handlebars until the master cylinder reservoir is level.

NOTE

To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.

6. Remove cover from master cylinder reservoir.

NOTE

Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.

7. Remove banjo bolt from master cylinder. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard copper washers.
8. Using a clean shop cloth, wipe out any remaining fluid in the master cylinder reservoir.
9. Disconnect brake lines from both front brake calipers. Discard copper washers.
10. Remove front brake line from motorcycle.

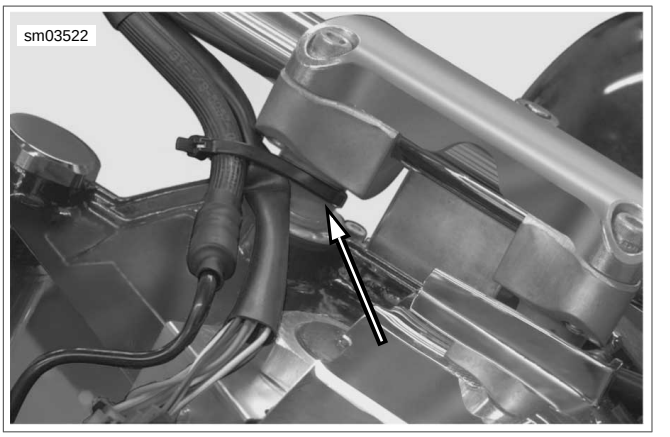


Figure 2-56. Capture Brake Hose and Right Handlebar Riser (FLHR/C)

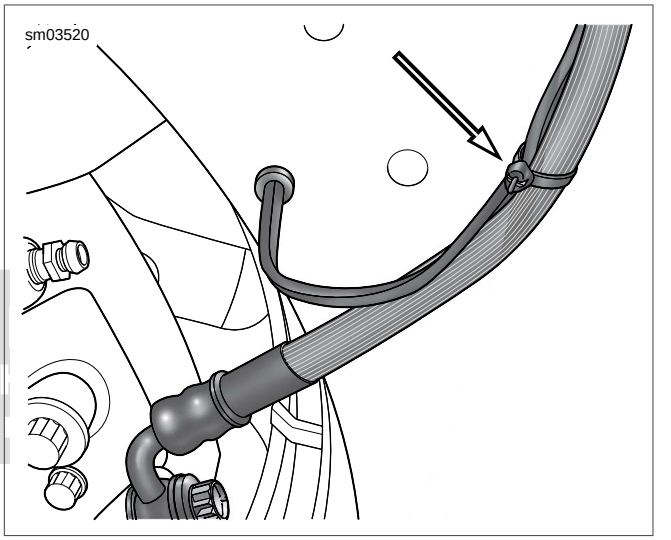


Figure 2-57. Capture Brake Hose and Front Fender Tip Lamp Wires

Installation

1. Position the front brake line bracket at the bottom of the lower fork bracket, so that single brake line runs up to the master cylinder reservoir. Loosely attach brake line bracket with screw.
2. Verify that brake lines are equal distance from the left and right fork sliders, and tighten screw until snug.
3. Start banjo bolt (with **new** copper washers) to secure brake line to master cylinder reservoir.
4. Secure brake lines to master cylinder and brake calipers using **new** copper washers.
5. Tighten banjo bolt to master cylinder reservoir to 12.5-14.5 ft-lbs (17.0-19.7 Nm).
6. Tighten banjo bleeder bolts to brake calipers to 17-19 ft-lbs (23.1-25.8 Nm).
7. Tighten brake line bracket screw to 120-180 **in-lbs** (13.6-20.3 Nm).

8. Fill and bleed brake system. See 1.16 BLEEDING BRAKES.
9. **FLHR/C:**
 a. See Figure 2-56. Install **new** cable strap to secure right handlebar switch conduit and brake hose to right handlebar riser.
 b. Install right side headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
 c. See Figure 2-57. Install **new** cable strap to secure front fender tip lamp wires to left brake caliper hose.
10. **FLHX, FLHT/C/U:**
 a. Just outboard of fairing cap opening, install **new** cable strap to secure right handlebar switch conduit and brake line to right handlebar.
 b. Install fairing cap and outer fairing. See 2.38 FAIRING CAP: FLHX, FLHT/C/U and 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, respectively.
 c. See Figure 2-57. Install **new** cable strap to secure front fender tip lamp wires to left brake caliper hose.
11. **FLTR:**
 a. If present, capture brake line in P-clip. Install hex screw to fasten P-clip to front right side of upper fork bracket.
 b. Install right side instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.

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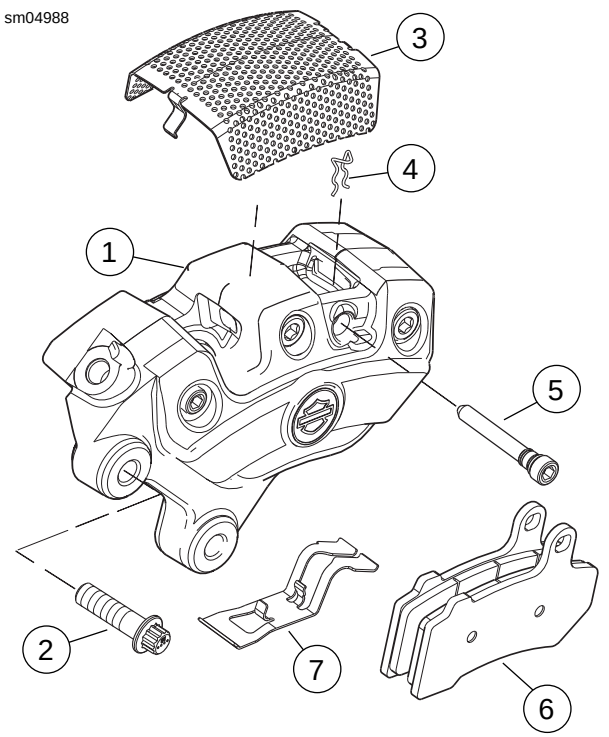
FRONT BRAKE CALIPER 2.15

REMOVAL

NOTES

- *If only replacing brake pads, see 1.15 BRAKE PADS AND DISCS.*
- *Wrap banjo fitting with piece of shop towel to absorb any loss of brake fluid.*

1. Remove banjo bleeder bolt to release brake line to caliper. Discard copper washers.
2. See Figure 2-58. Remove two caliper mounting screws. Remove caliper from brake disc.



1. **Caliper**
2. **Caliper mounting screw**
3. **Screen**
4. **Retaining clip**
5. **Pad pin**
6. **Brake pads**
7. **Pad spring**

Figure 2-58. Front Brake Caliper Assembly

INSTALLATION

1. If necessary, assemble caliper installing pad spring, brake pads, pad pin, retaining clip and screen. See 1.15 BRAKE PADS AND DISCS.
2. Slide caliper onto brake disc and start two mounting screws (with cable clip/bracket if left side caliper on ABS equipped motorcycle). Tighten to 28-38 ft-lbs (37.9-51.5 Nm).
3. **Left side caliper of ABS equipped motorcycles only:** Install front wheel speed sensor cable into clip as follows:
 a. Rotate tab (stamped ABS) until clip is perpendicular to bracket and install cable.
 b. Rotate tab forward until clip is inline with bracket and then apply pressure to tab until lip engages. Gently pull on cable to verify that clip is properly installed.
4. If ABS equipped, install two **new** cable straps as follows:
 a. Install cable strap 2.5 in. (63.5 mm) above the bottom brake hose crimp capturing front wheel speed sensor cable and brake hose.
 b. Install cable strap 2.5 in. (63.5 mm) below the top brake hose crimp capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.
5. Start banjo bleeder bolt (with **new** copper washers) to secure brake line to caliper. Tighten bolt to 17-19 ft-lbs (23.1-25.8 Nm).

NOTE

When replacing or installing the bleeder valve, remove the o-ring from the bleeder valve groove or bore and discard. The o-ring is required only for brake bleeding at the factory. Although not sold separately, it may be present in certain assemblies as currently sold. If care is not taken to remove and discard the o-ring, it may become lodged in the banjo bleeder bolt bore during bleeder valve installation and prevent proper torquing or sealing.

6. Fill and bleed brake system. See 1.16 BLEEDING BRAKES.

REAR BRAKE MASTER CYLINDER 2.16

GENERAL

⚠CAUTION

Direct contact of D.O.T. 4 brake fluid with eyes can cause irritation. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts of D.O.T. 4 brake fluid can cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN. (00240a)

CAUTION

D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)

CAUTION

Do not allow dirt or debris to enter the master cylinder reservoir. Dirt or debris in the reservoir can cause improper operation and equipment damage. (00205c)

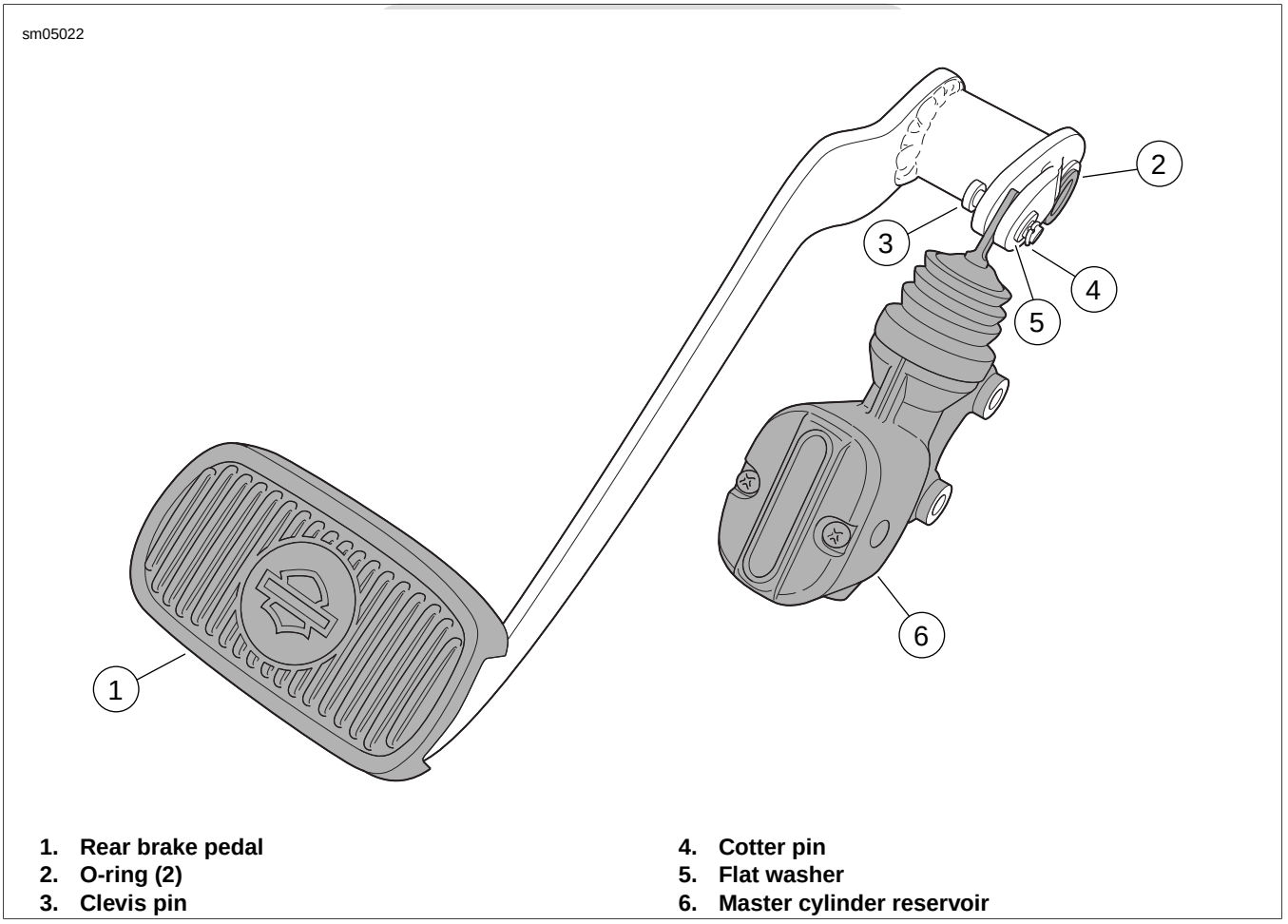
NOTE

Immediately wipe up any brake fluid spillage with a clean, dry, soft cloth. Follow up by thoroughly wiping affected area with a clean, damp, soft cloth (small spills) or washing with a large quantity of soapy water (large spills).

REMOVAL AND DISASSEMBLY

Removal

1. Remove right lower fairing, if present. See 2.36 LOWER FAIRING AND ENGINE GUARD.
2. Remove right side rider footboard. See 2.52 FOOTBOARDS AND FOOTRESTS.
3. Stand motorcycle upright, so that rear master cylinder reservoir is level.
4. To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.
5. Remove cover from master cylinder reservoir.



1. **Rear brake pedal**
2. **O-ring (2)**
3. **Clevis pin**
4. **Cotter pin**
5. **Flat washer**
6. **Master cylinder reservoir**

Figure 2-59. Rear Master Cylinder/Brake Pedal Assembly

NOTE

Wrap banjo fitting with piece of shop towel to absorb any loss of brake fluid.

6. Remove brake line from master cylinder reservoir. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard copper washers.
7. Using a clean shop cloth, wipe out any remaining fluid in the master cylinder reservoir.
8. Remove master cylinder from engine mount end cap.
9. Remove locknut with flat washer and pull brake pedal/master cylinder assembly from pedal shaft. Remove and discard O-ring on each side of brake pedal shaft bore.
10. See Figure 2-59. Remove cotter pin and flat washer from clevis pin. Remove clevis pin to separate master cylinder assembly from brake pedal flange.

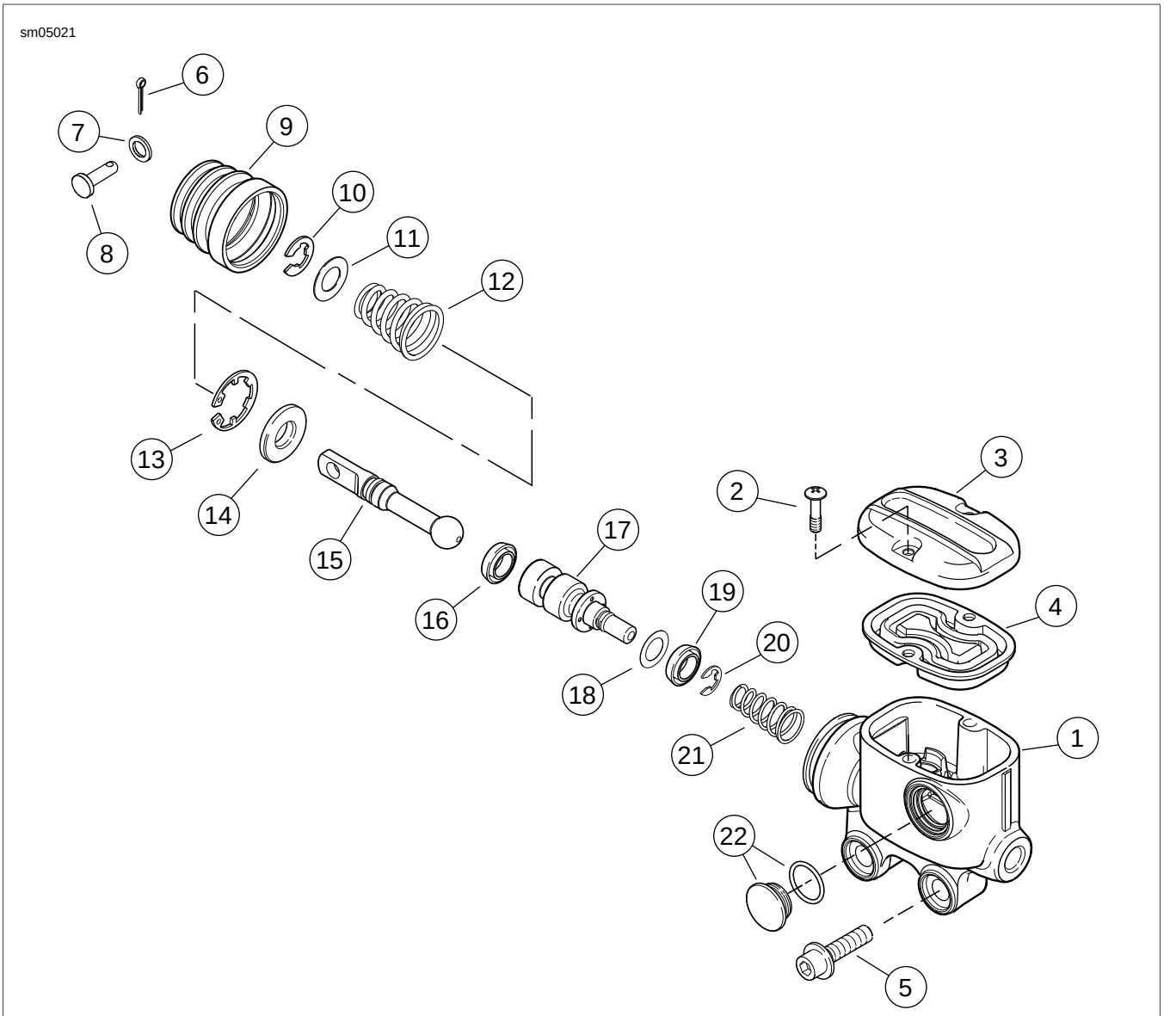
Disassembly

NOTE

Exercise care to avoid scratching or nicking banjo sealing surface during handling. Damage to the sealing surface requires replacement of the master cylinder reservoir.

1. See Figure 2-60. Remove dust boot (9) from reservoir pulling it over slotted end of pushrod.
2. Pushing down on flat washer (11) to compress pedal return spring (12), remove E-clip (10) from groove in pushrod, and then carefully release spring.
3. Remove flat washer and pedal return spring from pushrod.
4. Push on end of piston to remove tension and remove retaining ring (13) from groove in piston bore.
5. Remove pushrod (15) and special washer (14).
6. Pull piston assembly from piston bore.

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1. Master cylinder reservoir
2. Cover screw (2)
3. Cover
4. Gasket
5. Screw (2)
6. Cotter pin
7. Flat washer
8. Clevis pin
9. Dust boot
10. E-clip
11. Flat washer
12. Pedal return spring
13. Retaining ring
14. Special washer
15. Pushrod
16. Secondary seal
17. Piston
18. Flat washer
19. Primary seal
20. E-clip
21. Spring
22. Sight glass/O-ring

Figure 2-60. Rear Brake Master Cylinder Assembly

CLEANING AND INSPECTION

WARNING

Use denatured alcohol to clean brake system components. Do not use mineral-based solvents (such as gasoline or paint thinner), which will deteriorate rubber parts even after assembly. Deterioration of these components can cause brake failure, which could result in death or serious injury. (00291a)

WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

1. Clean all parts with denatured alcohol. Wipe dry with a clean, lint free cloth.
2. Inspect banjo seating surface for scratches or nicks.
3. Verify that reservoir is completely free of dust, dirt or residue.
4. Using a clean air supply, blow out piston bore and other drilled passages. Do not use a wire or similar instrument.
5. Inspect piston bore for scratches, nicks, scoring, pitting, corrosion or other damage.
6. Inspect retaining ring and E-clip for wear or distortion. Inspect retaining ring and E-clip grooves for damage.
7. Inspect springs for stretching, distortion, kinks, cracks or broken coils.
8. Inspect piston seals, dust boot and reservoir cover gasket for cuts, tears or general deterioration.

ASSEMBLY AND INSTALLATION

Assembly

1. Lightly lubricate piston bore and OD of piston seals with D.O.T. 4 brake fluid.
2. Insert spring end of piston assembly into piston bore.
3. Slide special washer and retaining ring over pushrod. Collar on ID of special washer should face slotted end of pushrod, while flat side of retaining ring should face ball end.
4. Use ball end of pushrod to compress spring and install retaining ring in groove of piston bore. Verify that retaining ring is completely seated in groove.
5. Slide pedal return spring over pushrod until larger diameter coil is seated on retaining ring in piston bore.
6. Slide flat washer over pushrod until seated on smaller diameter coil of pedal return spring.
7. Using a suitable spring compressor, compress pedal return spring and install E-clip in inboard groove of pushrod.
8. Slide open end of dust boot over pushrod and onto reservoir until ID on closed end is captured in outboard groove of pushrod.

Installation

1. Install master cylinder assembly onto brake pedal flange. Install clevis pin from the outboard side. Install flat washer and cotter pin on clevis pin.
2. Apply a light coat of Wheel Bearing Grease (HD Part No. 99855-89) to the brake pedal shaft and bore. Install **new** O-ring on each side of bore.
3. Install brake pedal/master cylinder assembly on the pedal shaft. Install flat washer and **new** locknut on pedal shaft.
4. Install two screws to fasten master cylinder to engine mount end cap. Alternately tighten screws to 10.5-12.5 ft-lbs (14-17 Nm).
5. Tighten brake pedal shaft locknut to 15-20 ft-lbs (20-27 Nm).
6. Start banjo bolt (with new copper washers) to secure brake line to master cylinder reservoir. Tighten banjo bolt to 13-15 ft-lbs (17.6-20.3 Nm).

WARNING

Any time the ABS module, either master cylinder, or any line between a master cylinder and the ABS module is disconnected or replaced, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to do so could result in air in the hydraulic brake system, reducing brake efficiency, which could result in death or serious injury. (00585b)

7. Fill and bleed brake system. See 1.16 BLEEDING BRAKES.
8. Install right side rider footboard. See 2.52 FOOTBOARDS AND FOOTRESTS.

REAR BRAKE LINE: NON-ABS EQUIPPED

Removal

1. Remove right side saddlebag. See 2.29 SADDLEBAGS.
2. Remove right side cover.
3. Remove right lower fairing, if present. See 2.36 LOWER FAIRING AND ENGINE GUARD.
4. Remove right side rider footboard. See 2.52 FOOTBOARDS AND FOOTRESTS.
5. See Figure 2-61. Free rear brake line from electrical harness conduit clips (6).
6. Remove socket terminals from rear brake light switch (4) spade contacts. Cut cable strap to free rear brake light switch wires from lower frame tube, if necessary.
7. Remove fastener (5) and brake light switch bracket from frame.
8. Free rear brake line hose from cable clips (3) on rear fork.

9. Stand motorcycle upright, so that rear master cylinder reservoir is level.

NOTE

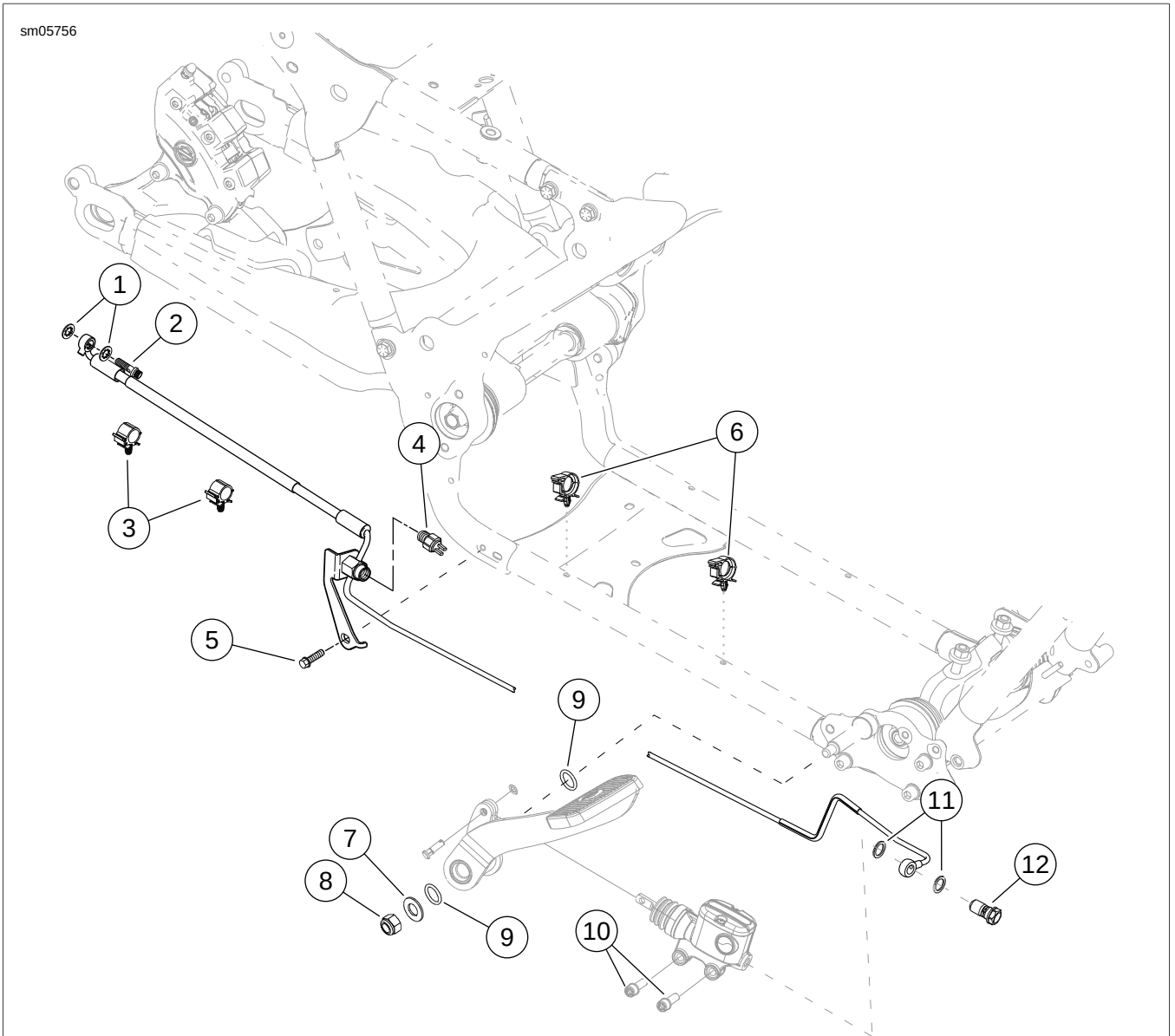
To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.

10. Remove cover from master cylinder reservoir.

NOTE

Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.

11. Remove banjo bolt (12) from master cylinder reservoir. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard sealing washers (11).
12. Using a clean shop cloth, wipe out any remaining fluid in the master cylinder reservoir.
13. Remove screws (10) securing master cylinder to frame.
14. Remove locknut (8) with flat washer (7) and pull brake pedal/master cylinder assembly from pedal shaft. Remove and discard O-rings (9).
15. Remove banjo bolt (2) from rear brake caliper. Discard sealing washers (1).
16. Feed rear brake line hose forward to area in front of rear fork bracket. Remove rear brake line from motorcycle.



1. **Sealing washers**
2. **Banjo bolt**
3. **Cable clips**
4. **Rear brake light switch**
5. **Fastener**
6. **Electrical harness conduit clips**
7. **Flat washer**
8. **Locknut**
9. **O-ring**
10. **Fastener**
11. **Sealing washers**
12. **Banjo bolt**

Figure 2-61. Rear Brake Line Assembly

Installation

1. Place rear brake line into approximate position along top of lower right frame tube. From area in front of rear fork bracket, feed brake line hose rearward following top of rear fork.
2. Move front section of brake line inboard of frame at bottom of front frame downtube.
3. See Figure 2-61. Secure brake line to caliper using **new** sealing washers.
4. Capture rear brake line hose in two cable clips (3) on rear fork.

NOTE

*If installing **new** rear brake light switch, apply Loctite Pipe Sealant with Teflon 565 to threads and start switch into rear brake line. Using flats on switch, tighten to 12-15 ft-lbs (16.3-20.3 Nm).*

5. Index locating tab on brake light switch bracket in slot of frame. Install fastener (5) and tighten to 80-100 **in-lbs** (9.0-11.3 Nm).
6. Install terminals onto rear brake light switch (4). If removed, install **new** cable strap to secure rear brake light switch wires.
7. Capture rear brake line to electrical harness conduit clips (6).
8. Apply a light coat of Wheel Bearing Grease (HD Part No. 99855-89) to the brake pedal shaft and bore. Install **new** O-rings (9) on each side of bore.
9. Install brake pedal/master cylinder assembly on the pedal shaft. Install flat washer (7) and **new** locknut (8) on pedal shaft.
10. Fasten master cylinder to frame. Tighten screws to 126-150 **in-lbs** (14.2-17.0 Nm).
11. Tighten brake pedal shaft locknut to 15-20 ft-lbs (20-27 Nm).
12. Secure brake line to master cylinder reservoir using new sealing washers. Tighten banjo bolt to 12.5-14.5 ft-lbs (16.9-19.7 Nm).
13. Tighten banjo bolt to brake caliper to 17-19 ft-lbs (23.1-25.8 Nm).
14. Fill and bleed brake system. See 1.16 BLEEDING BRAKES.
15. Install right side rider footboard. See 2.52 FOOTBOARDS AND FOOTRESTS.
16. Install right lower fairing, if present. See 2.36 LOWER FAIRING AND ENGINE GUARD.
17. Install right side cover.
18. Install right side saddlebag. See 2.29 SADDLEBAGS.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

REAR BRAKE CALIPER 2.17

REMOVAL

NOTE

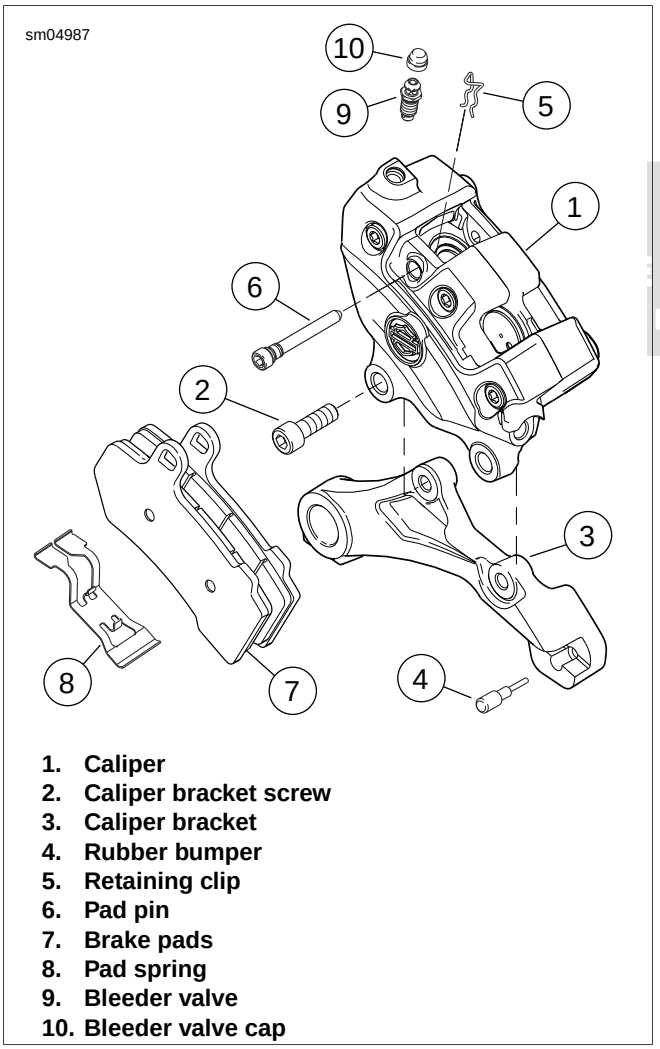
If only replacing brake pads, see 1.15 BRAKE PADS AND DISCS.

1. Remove right side saddlebag. See 2.29 SADDLEBAGS.

NOTE

Wrap banjo fitting with piece of shop towel to absorb any loss of brake fluid.

2. Remove banjo bolt to release brake line from caliper. Discard copper washers.
3. See Figure 2-62. Remove two screws (2) to release caliper from caliper bracket.
4. Remove caliper from brake disc.
5. If necessary, retract rear axle to remove caliper bracket (3). See 2.5 REAR WHEEL.



1. **Caliper**
2. **Caliper bracket screw**
3. **Caliper bracket**
4. **Rubber bumper**
5. **Retaining clip**
6. **Pad pin**
7. **Brake pads**
8. **Pad spring**
9. **Bleeder valve**
10. **Bleeder valve cap**

Figure 2-62. Rear Brake Caliper Assembly

INSTALLATION

1. Install caliper bracket, if removed. Proceed as follows:
 a. Replace rubber bumper if damaged, worn or missing. Lubricate anchor of **new** bumper with isopropyl alcohol or glass cleaner and pull rubber bead through hole to the inboard side of the caliper bracket.
 b. Seat caliper bracket on anchor weldment of rear swingarm.
 c. Complete installation of rear wheel. See 2.5 REAR WHEEL.
2. If necessary, assemble caliper by installing pad spring, brake pads, pad pin and retaining clip. See 1.15 BRAKE PADS AND DISCS.

NOTE

When replacing or installing the bleeder valve, remove the O-ring from the bleeder valve groove or bore and discard. The O-ring is required only for brake bleeding at the factory. Although not sold separately, it may be present in certain assemblies as currently sold. If care is not taken to remove and discard the O-ring, it may become lodged in the caliper bore during bleeder valve installation and prevent proper torquing or sealing.

3. Install caliper and secure with two screws. Tighten screws to 43-48 ft-lbs (58.3-65.1 Nm).
4. Secure brake line to caliper. Tighten banjo bolt to 17-19 ft-lbs (23.1-25.8 Nm).
5. Fill and bleed brake system. See 1.16 BLEEDING BRAKES.
6. Install right side saddlebag. See 2.29 SADDLEBAGS.

TIRES 2.18

GENERAL

⚠WARNING

Use only Harley-Davidson approved tires. See a Harley-Davidson dealer. Using non-approved tires can adversely affect stability, which could result in death or serious injury. (00024a)

⚠WARNING

Be sure tires are properly inflated, balanced and have adequate tread. Inspect your tires regularly and see a Harley-Davidson dealer for replacements. Riding with excessively worn, unbalanced or under-inflated tires can adversely affect stability and handling, which could result in death or serious injury. (00014a)

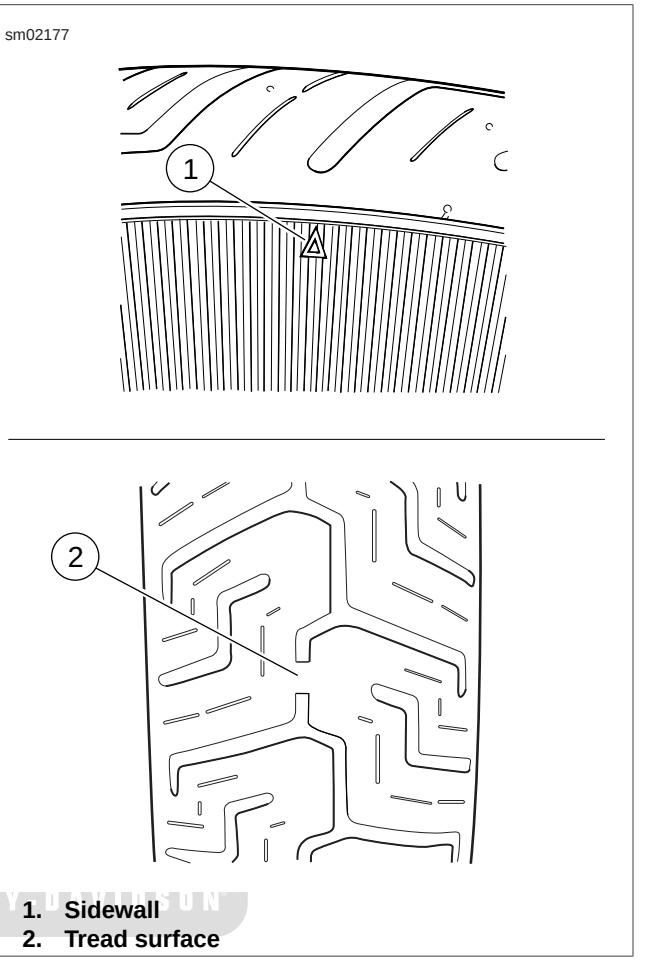
New tires should be stored on a horizontal tire rack. Avoid stacking new tires in a vertical stack. The weight of the stack compresses the tires and closes down the beads.

Tires should be inspected for punctures, cuts, breaks and wear at least weekly.

See Figure 2-63. The tread wear indicator bars will appear on tire tread surfaces when 1/32 in. (0.8 mm) or less of tread remains. Always remove tires from service before they reach the tread wear indicator bars.

New tires are needed if any of the following conditions exist. See 1.10 TIRES AND WHEELS.

1. Tire wear indicator bars are visible on the tread surfaces.
2. Tire cords or fabric are visible through cracked sidewalls, snags or deep cuts.
3. A bump, bulge or split in the tire.
4. Puncture, cut or other damage to the tire that cannot be repaired.



1. **Sidewall**
2. **Tread surface**

Figure 2-63. Tread Wear Indicators (Typical)

REMOVAL

NOTE

Care must be taken when removing and installing tire to prevent cosmetic damage to wheel. This is especially true with wheels that feature painted surfaces.

1. Remove wheel from motorcycle:
 a. **Front wheel:** see 2.4 FRONT WHEEL, Removal.
 b. **Rear wheel:** see 2.5 REAR WHEEL, Removal.
2. Deflate tire.

NOTE

On tube type wheels, it is not necessary to completely remove tire from rim. Removing one side allows the tube to be replaced and allows for inspection of tire.

3. Loosen both tire beads from rim flange. In most cases, a bead breaker machine will be required to loosen the beads from the rim.
4. Remove tire.

CLEANING, INSPECTION AND REPAIR

1. Clean the inside of tire and outer surface of tube.
2. If rim is dirty or rusty, clean with a stiff wire brush.
3. Check wheels for lateral and radial runout before installing a new tire.
 a. **Models with laced wheels:** see 2.12 TRUING LACED WHEELS.
 b. **Models with cast wheels:** see 2.13 CHECKING CAST WHEEL RUNOUT.
4. Inspect the tire and tube for wear and damage. Inspect tread depth. Replace worn tires. Replace damaged tubes.

WARNING

Replace punctured or damaged tires. In some cases, small punctures in the tread area may be repaired from within the demounted tire by a Harley-Davidson dealer. Speed should NOT exceed 50 mph (80 km/h) for the first 24 hours after repair, and the repaired tire should NEVER be used over 80 mph (130 km/h). Failure to follow this warning could result in death or serious injury. (00015a)

5. Tubeless tires may be repaired in the tread area only if the puncture is 1/4 in. (6.4 mm) or smaller. All repairs must be made from inside the tire.
6. Acceptable repair method involves the use of a patch and plug combination.

INSTALLATION

WARNING

Harley-Davidson front and rear tires are not the same. Interchanging front and rear tires can cause tire failure, which could result in death or serious injury. (00026a)

WARNING

Do not exceed manufacturer's recommended pressure to seat beads. Exceeding recommended bead seat pressure can cause tire rim assembly to burst, which could result in death or serious injury. (00282a)

WARNING

Do not inflate tire beyond maximum pressure as specified on sidewall. Over inflated tires can blow out, which could result in death or serious injury. (00027a)

For tire pressures, see 1.10 TIRES AND WHEELS, Tires.

Some tires have arrows molded into the tire sidewall. These tires should be mounted on the rim with the arrow pointing in the direction of forward rotation. The colored dot on the sidewall is a balance mark and should be located next to the valve stem hole.

Tube Type Tires

WARNING

Match tires, tubes, air valves and caps to the correct wheel rim. Contact a Harley-Davidson dealer. Mismatching can result in damage to the tire bead, allow tire slippage on the rim or cause tire failure, which could result in death or serious injury. (00023a)

WARNING

Use inner tubes on laced (wire spoked) wheels. Using tubeless tires on laced wheels can cause air leaks, which could result in death or serious injury. (00025a)

NOTES

- *For correct tire and tube types, see 2.2 SPECIFICATIONS.*
- *Whenever a tube type tire is replaced, the tube should also be replaced. Inner tubes should be patched only as an emergency measure. Replace a damaged or patched tube as soon as possible. Rim bands must be used on all laced wheels.*

1. See Figure 2-64. On laced wheels, install a rim strip into the rim well. Make sure no spokes protrude through nipples, and be sure to align the valve stem hole in rim strip with valve stem hole in rim.
2. Install tube and tire.



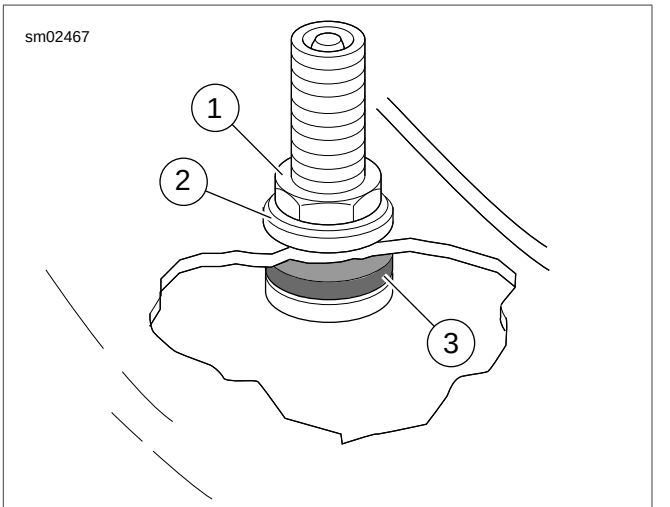
Figure 2-64. Installing Rim Strip

Tubeless Tires

WARNING

Only install original equipment tire valves and valve caps. A valve, or valve and cap combination, that is too long or too heavy can strike adjacent components and damage the valve, causing rapid tire deflation. Rapid tire deflation can cause loss of vehicle control, which could result in death or serious injury. (00281a)

1. See Figure 2-65. On tubeless wheels, damaged or leaking valve stems must be replaced. Install rubber grommet (3) on valve stem.
2. Insert valve stem into rim hole.
3. Install metal washer (2).
4. Install nut and tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
5. Install tire.



1. **Nut**
2. **Metal washer**
3. **Rubber grommet**

Figure 2-65. Tubeless Tire Valve Stem

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FRONT FORK 2.19

CHANGING FORK OIL

PART NUMBER	TOOL NAME
HD-41177	FORK TUBE HOLDER
HD-59000B	FORK OIL LEVEL GAUGE

NOTE

If changing oil at a routine service interval, or if fork is leaking or fails visual inspection, complete disassembly and inspection of the fork is required. See 2.19 FRONT FORK, Disassembly. However, if only replacing the fork oil, see procedure below.

Draining

1. Remove fork. See 2.19 FRONT FORK, Removal.

CAUTION

Exercise caution to avoid scratching or nicking fork tube. Damaging tube can result in fork oil leaks after assembly. (00421b)

2. Clamp FORK TUBE HOLDER (Part No. HD-41177) in vise in a horizontal position.
3. See Figure 2-69. With the fork cap bolt topside, clamp fork tube securely in tool.
4. See Figure 2-70. Remove fork cap bolt (1). Remove and discard quad ring seal (2).
5. Carefully remove fork tube plug (3) from fork tube. Fork tube plug is under spring pressure, so have a firm grasp on plug as the last thread is turned. Remove and discard o-ring (4) from fork tube plug.
6. Remove fork spring (5) from fork tube.
7. Remove fork assembly from fork tube holder.

NOTE

Be aware that damper valve (6), if equipped, may fall out of inverted fork tube while draining.

8. Turn fork upside down to drain fork oil into drain pan. For best results, slowly pump fork tube and slider at least ten times. Allow sufficient time for fork to thoroughly drain (about 10-15 minutes).
9. With the fork tube topside, clamp fork slider (not the fork tube) into fork tube holder.
10. Install the drain plug at the bottom of the fork slider, if removed. Tighten plug to 72-96 **in-lbs** (8-11 Nm).

NOTE

All touring models, with the exception of Road King, have a damper valve type fork on both the left and right sides. Road King uses the conventional type fork on both sides. Be sure to follow the correct step for the fork type being serviced.

Table 2-18. Fork Oil Requirements

MODEL	FORK TYPE	AMOUNT			
		OZ.	ML	IN.	MM
All models **except** Road King	Damper Valve	10.7	317	4.92	125
Road King	Conventional	11.0	325	4.92	125

Filling

1. Pour slightly more Harley-Davidson Type E Fork Oil directly into the fork tube than is specified in Table 2-18.
2. Slowly pump fork tube until some resistance is felt and then pump a few more times.
3. **FLHX, FLHT/C/U, FLTR Models** (damper valve type fork):
 a. See Figure 2-70. Install **new** wear ring (7) in groove of damper valve (6). With the wear ring at the bottom (spring side up), slide damper valve into fork tube.
 b. Install fork spring (5) into fork tube. Use fork spring to push damper valve to bottom of fork tube. Remove fork spring from fork tube.
 c. Slowly pump fork tube a few more times to discharge air from damper valve.

WARNING

Incorrect amount of fork oil can adversely affect handling and lead to loss of vehicle control, which could result in death or serious injury. (00298a)

4. See Figure 2-66. Adjust metal ring of FORK OIL LEVEL GAUGE (Part No. HD-59000B) to specification in Table 2-18.
5. See Figure 2-67. With the fork tube bottomed in the fork slider, insert tube of gauge until metal ring rests flat on top of fork tube.
6. Use oil level gauge plunger to draw oil from fork. If no oil is drawn out, add a small amount to the fork tube and repeat.
7. With the closer spaced coils at the bottom, slide fork spring into fork tube.
8. Remove fork slider from fork tube holder. Clamp fork tube into fork tube holder.
9. See Figure 2-70. Install **new** o-ring (4) onto fork tube plug (3). Install fork tube plug and tighten to 60-70 ft-lbs (81.4-94.9 Nm).
10. Install **new** quad ring seal (2) onto fork cap bolt (1) and install into fork tube plug to prevent loss of fork oil while handling.
11. On right side fork, loosely install axle holder, flat washers, lockwashers and nuts on fork slider.

12. Install fork and assemble motorcycle. See 2.19 FRONT FORK, Installation.

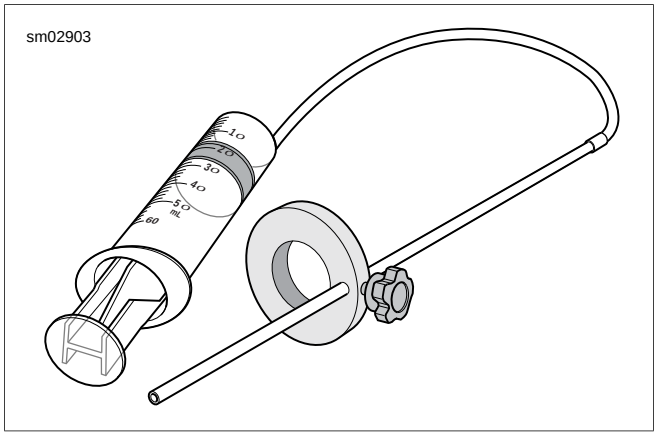


Figure 2-66. Fork Oil level Gauge (HD-59000B)

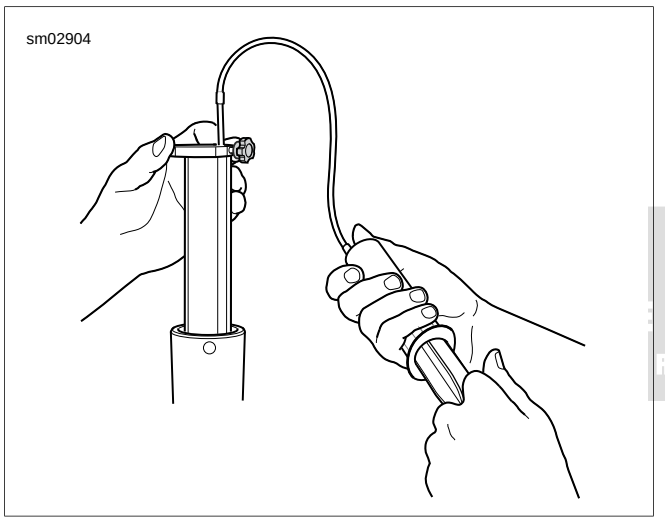
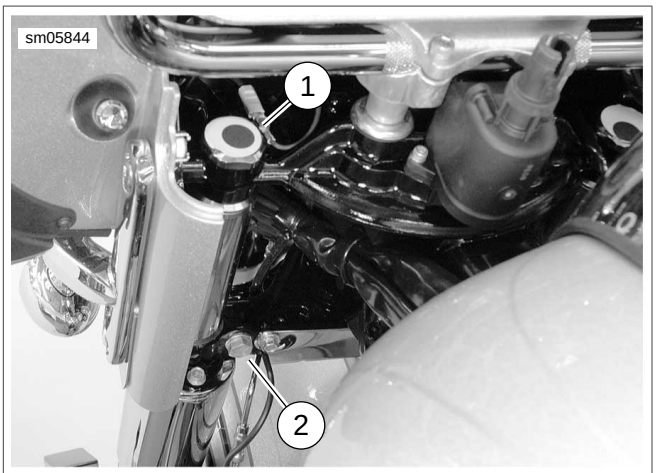


Figure 2-67. Remove Excess Fork Oil

REMOVAL

1. Place suitable blocking under frame to raise front wheel several inches off the floor. For best results, use an hydraulic center stand on a level surface.
2. Remove the front wheel and fender. See 2.48 FRONT FENDER and 2.4 FRONT WHEEL.
3. **FLHR/C:** Remove headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
4. **FLHX, FLHT/C/U:** Remove inner fairing cap. See 2.38 FAIRING CAP: FLHX, FLHT/C/U.
5. **FLTR:** Remove instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.
6. See Figure 2-68. Loosen fork cap bolt (1), but do not remove.



1. **Fork cap bolt**
2. **Pinch bolt**

Figure 2-68. Front Fork Attachment (FLHR/C Shown)

7. Loosen pinch bolt (2), but do not remove.
8. Holding fork slider to prevent fork from dropping, remove fork cap bolt from fork tube plug. Slide fork tube down to remove.
9. Loosely install fork cap bolt to prevent loss of fork oil while handling.
10. Repeat procedure for other fork.

DISASSEMBLY

1. Remove the fork assembly. See 2.19 FRONT FORK, Removal.
2. On right side fork, remove nuts, lockwashers, flat washers and axle holder from studs at end of fork slider.

CAUTION

Exercise caution to avoid scratching or nicking fork tube. Damaging tube can result in fork oil leaks after assembly. (00421b)

3. Drain fork. See the draining procedure in 2.19 FRONT FORK, Changing Fork Oil.
4. Install fork spring back into fork tube.
5. See Figure 2-70. Place a shop rag on the floor, and turning fork assembly upside down, press end of spring against rag. While compressing spring to prevent rotation of damper tube, remove 6 mm screw (22) from end of fork slider. Use an air impact wrench for best results. Discard 6 mm screw and copper washer (21).
6. Remove fork spring (5), damper valve (6) (if equipped) and damper tube (9) from fork tube.
7. Remove wear ring (8) and rebound spring (10) from damper tube. Remove wear ring (7) from damper valve, if equipped.

NOTE

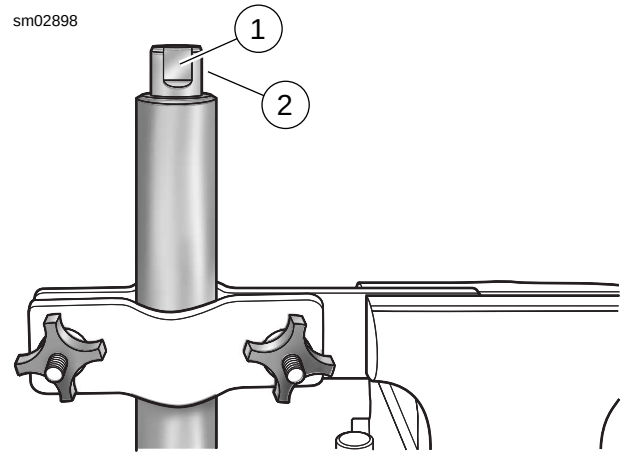
Do not expand or stretch retaining clip to remove from fork tube or clip may become bent or distorted.

8. Using pick tool, remove retaining clip (12) between fork slider and fork tube.
9. Remove fork tube from fork slider.

NOTE

To overcome any resistance, use the fork tube as a slide hammer by pushing fork tube into fork slider and then pull it outward with a moderate amount of force. Repeat this sequence until fork tube separates from fork slider.

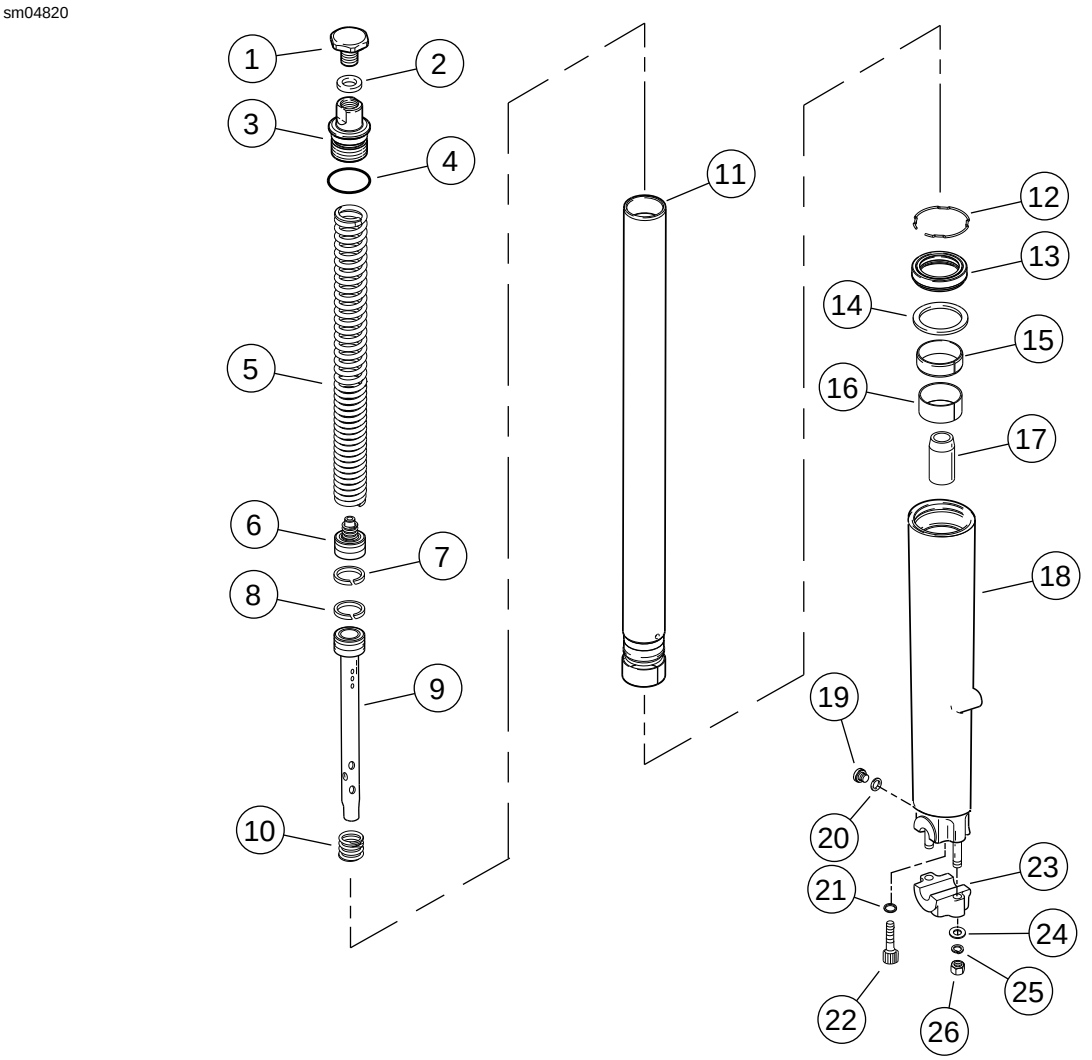
10. Slide fork oil seal (13), slider spacer (14) and slider bushing (15) off end of fork tube. Discard fork oil seal and slider bushing.
11. Gently pry at split line to expand fork leg bushing (16) and remove from groove at end of fork tube. Discard fork leg bushing.
12. Remove lower stop (17) from fork slider.



1. Flat
2. Fork tube plug

Figure 2-69. Install Fork Tube Into Fork Holder

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Fork cap bolt**
2. **Quad ring seal**
3. **Fork tube plug**
4. **O-ring**
5. **Spring**
6. **Damper valve (Fairing equipped only)**
7. **Wear ring (Fairing equipped only)**
8. **Wear ring**
9. **Damper tube**
10. **Rebound spring**
11. **Fork tube**
12. **Retaining clip**
13. **Lip seal**
14. **Slider spacer**
15. **Slider bushing**
16. **Fork leg bushing**
17. **Lower stop**
18. **Fork slider**
19. **Plug**
20. **Flat washer**
21. **Copper washer**
22. **Screw (6mm)**
23. **Axle holder**
24. **Flat washer (2)**
25. **Lockwasher (2)**
26. **Nut (2)**

Figure 2-70. Right Side Fork

CLEANING AND INSPECTION

1. Thoroughly clean and inspect all parts. Replace any parts that are bent, inoperative or obviously damaged.
2. Inspect fork cap bolt quad ring seal and fork tube plug o-ring for cuts, tears or signs of deterioration. Replace if necessary.
3. Replace retaining clip if bent or distorted.
4. Check slider and fork leg bushings for scratches or excessive wear. Always replace bushings in a set if either bushing is damaged or worn.

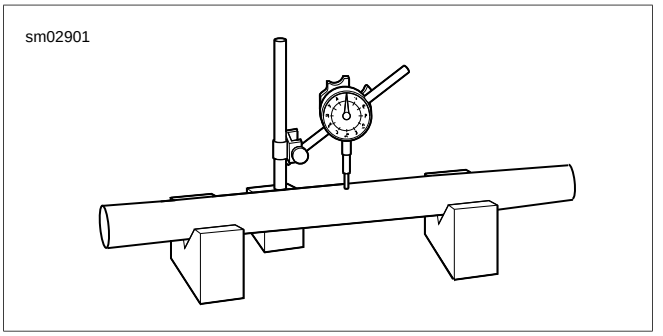


Figure 2-71. Measure Fork Tube Runout

5. See Figure 2-71. Check fork tube and slider for scoring, scratches and excessive or abnormal wear. Replace parts as necessary. Set fork tube on V-blocks and measure runout using a dial indicator gauge. Replace fork if runout exceeds 0.008 in. (0.2 mm).
6. Inspect upper fork spring and rebound spring for damage or distortion. Replace upper fork spring if free length is less than:
 a. **Non-Fairing Models:**19.27 in. (489.4 mm).
 b. **Fairing Models:**18.73 in. (475.7 mm).

 Replace rebound spring if free length is less than 0.938 in. (23.8 mm) or any time the upper fork spring is replaced.

ASSEMBLY

PART NUMBER	TOOL NAME
HD-34634	FORK OIL SEAL INSTALLER
HD-41177	FORK TUBE HOLDER

CAUTION

Exercise caution to avoid scratching or nicking fork tube. Damaging tube can result in fork oil leaks after assembly. (00421b)

1. See Figure 2-70. Coat ID of fork leg bushing (16) with clean fork oil. Expand fork leg bushing at split line only enough to slip over end and into groove of fork tube.
2. Install **new** wear ring (8) in groove at top of damper tube (9). Install rebound spring (10) on opposite end.
3. With the wear ring topside, slide damper tube into fork tube, so that tube end drops through hole at bottom of fork tube. Install lower stop (17) at end of damper tube.
4. Install fork slider in FORK TUBE HOLDER (Part No. HD-41177). Slide fork tube into fork slider.
5. Coat ID of slider bushing (15) with clean fork oil. Slide slider bushing down fork tube.
6. See Figure 2-72. Slide FORK OIL SEAL INSTALLER (Part No. HD-34634) down the fork tube, and using the tool like a slide hammer, drive slider bushing into counterbore of fork slider. Remove tool.

NOTE

Place masking tape over edge of fork tube to avoid damaging lip of fork oil seal during installation.

7. Coat ID of **new** fork oil seal (13) with clean fork oil. With the lip garter spring side facing down (toward the fork slider), slide seal down fork tube until it contacts slider spacer (15). Remove masking tape from edge of fork tube.
8. See Figure 2-73. Using the tool like a slide hammer, drive fork oil seal down fork tube until retaining clip groove is visible in fork slider ID. Remove tool.

NOTE

Do not expand or stretch retaining clip to install on fork tube or clip may become bent or distorted.

9. Install retaining clip (12) in the fork slider groove.
10. Install fork spring (5) into fork tube.
11. Remove fork assembly from fork tube holder.



Figure 2-72. Fork Oil Seal Installer (HD-34634)

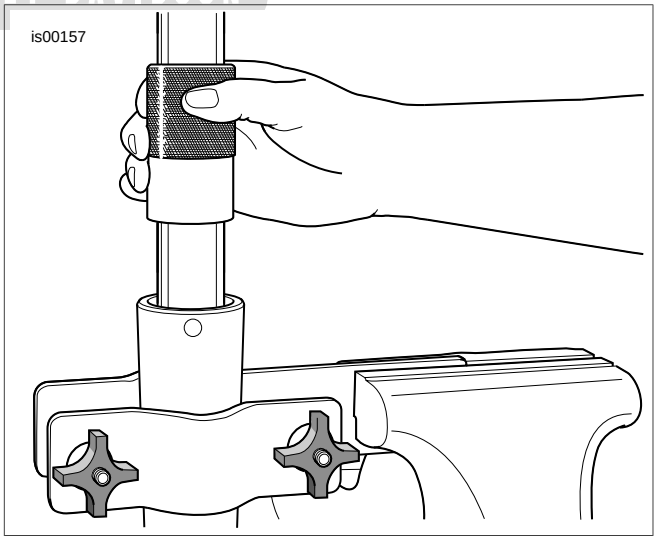


Figure 2-73. Install Fork Oil Seal

12. Place a shop rag on the floor. Turn fork assembly upside down and press end of spring against rag.
13. Install **new** 6 mm screw (22) with **new** copper crush washer (21) at bottom of fork slider.
14. While compressing spring to prevent rotation of damper tube, tighten 6 mm screw to 132-216 **in-lbs** (14.9-24.4 Nm).

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15. Remove fork spring from fork tube.
16. Fill fork and complete assembly. See the filling procedure in 2.19 FRONT FORK, Changing Fork Oil.
17. On right side fork, loosely install axle holder, flat washers, lockwashers and nuts on fork slider.

INSTALLATION

1. Remove fork cap bolt.
2. Slide fork tube up and into slider cover, lower fork bracket, fork stop, and upper fork bracket. Install fork cap bolt.
3. See Figure 2-68. Install pinch bolt (2) (with lockwasher) in lower fork bracket. Tighten pinch bolt to 53-57 ft-lbs (71.9-77.3 Nm).
4. Tighten fork cap bolt (1) to 60-70 ft-lbs (81.4-94.9 Nm).
5. Repeat previous steps on other fork, if removed.
6. Install the front fender and wheel. See 2.48 FRONT FENDER and 2.4 FRONT WHEEL.
7. **FLHR/C:** Install headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
8. **FLHX, FLHT/C/U:** Install fairing inner cap. See 2.38 FAIRING CAP: FLHX, FLHT/C/U.
9. **FLTR:** Install instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.

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AIR BAFFLE: FLTR 2.20

AIR BAFFLE (FLTR)

Removal

NOTE

By allowing the flow of air to pass under the fuel tank and over the cylinder heads, removing the air baffle evacuates heated air and provides some relief to the rider in warmer temperatures: 70 °F (21 °C) or above.

1. See Figure 2-74. Remove two hex screws (with flat washers) to release air baffle form lower fork bracket.
2. Install two hex screws (with flat washers) to keep dirt and debris out of holes in lower fork bracket. Tighten screws to 120-144 **in-lbs** (13.6-16.3 Nm).

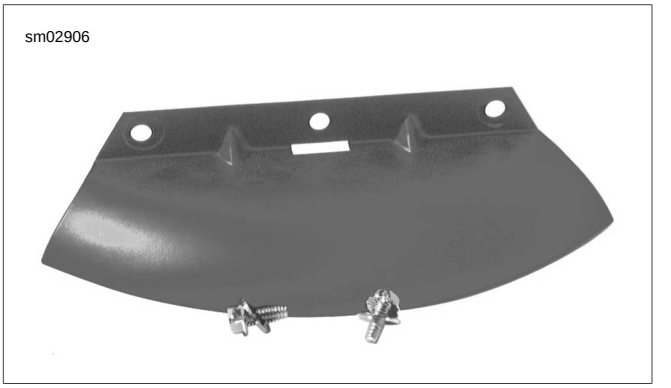


Figure 2-74. Air Baffle (FLTR)

Installation

NOTE

Install air baffle in colder weather.

1. With the concave side down, align holes in air baffle with holes at back of the lower fork bracket. Start two hex screws (with flat washers).

NOTE

Plastic plug(s) at back of lower fork bracket will prevent proper cover installation. Remove and discard plug(s), if present.

2. Tighten hex screws to 120-144 **in-lbs** (13.6-16.3 Nm).

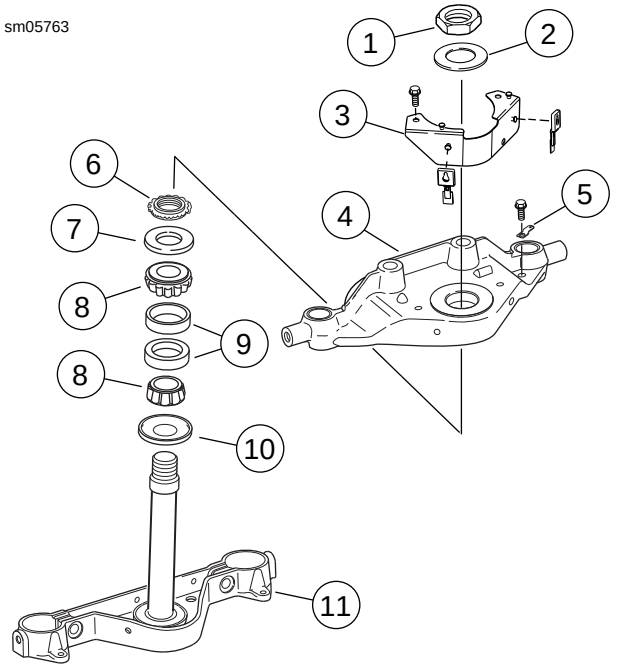
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

STEERING HEAD BEARINGS 2.21

REMOVAL

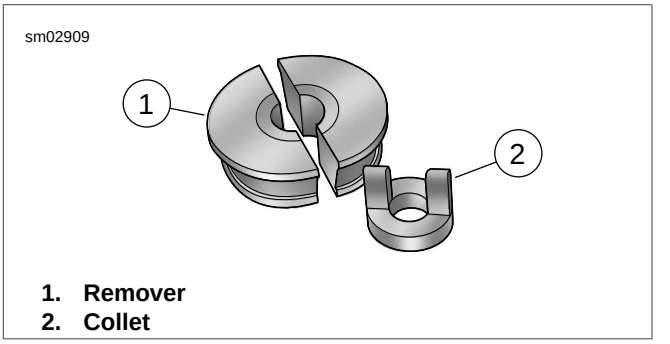
PART NUMBER	TOOL NAME
HD-33416	UNIVERSAL DRIVER
HD-39301A	STEERING HEAD BEARING CUP REMOVER

1. Disassemble motorcycle as follows:
 a. **FLHR/C:** Remove headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
 b. **FLHX, FLHT/C/U:** Remove the auxiliary lamp bracket, outer fairing and radio (storage box on FLHT). See 7.13 AUXILIARY LAMPS AND BRACKETS, 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 7.33 ADVANCED AUDIO SYSTEM, respectively.
 c. **FLTR:** Remove instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.
2. Remove front forks. See 2.19 FRONT FORK.



1. **Fork stem nut**
2. **Hardened flat washer**
3. **Bracket**
4. **Upper fork bracket**
5. **Spade contact**
6. **Bearing adjuster nut**
7. **Dust shield**
8. **Bearing cone**
9. **Bearing cup**
10. **Dust shield**
11. **Lower fork bracket**

Figure 2-75. Steering Head/Fork Bracket Assembly



1. **Remover**
2. **Collet**

Figure 2-76. Steering Head Bearing Cup Remover (Part No. HD-39301A)

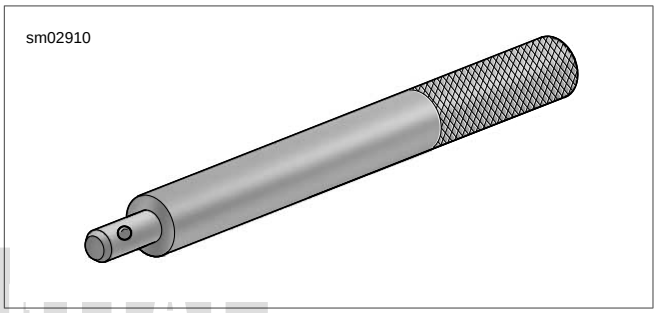


Figure 2-77. Universal Driver (Part No. HD-33416)

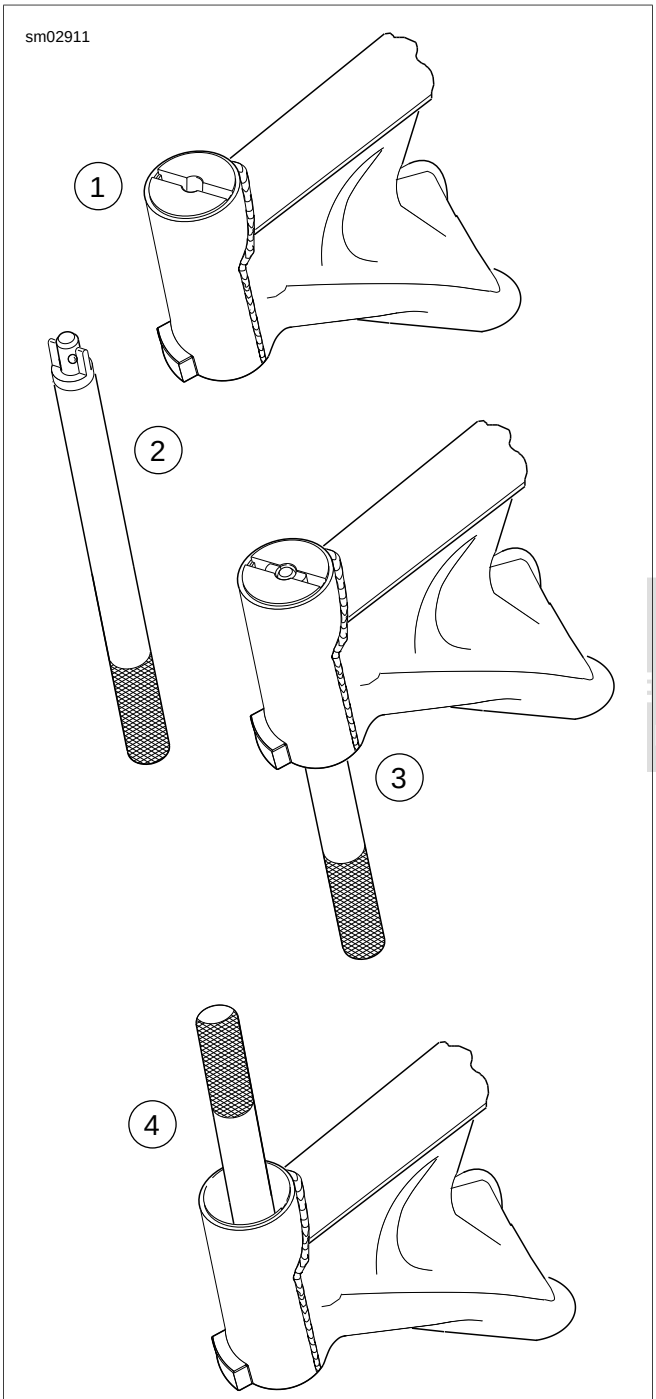
3. Release brake line bracket from lower fork bracket.
4. **FLTR:** Remove air baffle from lower fork bracket.
5. See Figure 2-75. Remove fork stem nut (1) and hardened flat washer (2).

NOTE

Bracket (3) does not need to be removed unless it or the upper fork bracket are to be replaced.

6. Disconnect ignition switch [33], left handlebar switch [24], right handlebar switch [22] and twist grip sensor jumper harness [204] connectors. On fairing equipped motorcycles, remove interconnect harness ground socket terminal from spade contact at front of upper fork bracket (left side).
7. Remove upper fork bracket (4).
8. Remove bearing adjuster nut (6).
9. Using a rubber mallet, tap on stem of lower fork bracket (11) and remove lower fork bracket.
10. Remove dust shield (7) and upper bearing cone (8).
11. Remove lower bearing cone (8) and dust shield (10) from stem of lower fork bracket.
12. See Figure 2-78. With the tapered side down, seat STEERING HEAD BEARING CUP REMOVER (Part No. HD-39301A) on the upper bearing cup leaving a gap in the middle.

13. See Figure 2-76. Install collet (2) on driver.
14. Insert UNIVERSAL DRIVER (Part No. HD-33416) driver up through bottom of steering head, and while holding remover tool on upper bearing cup, center collet in gap. Tap driver to remove upper bearing cup.
15. Reverse tool and repeat procedure to remove lower bearing cup.



1. **Install remover on upper cup**
2. **Install collet on driver**
3. **Install driver in remover and remove upper cup**
4. **Remove lower cup**

Figure 2-78. Remove Steering Head Bearing Cups

INSPECTION

1. Check the bearing races in the steering head. If pitted or grooved, replace both the bearings and races.
2. Turn bearings in races. Replace the bearings if they do not move freely and smoothly. Always replace both races and bearings even if one race and bearing appears good.

INSTALLATION

PART NUMBER	TOOL NAME
HD-39302	STEERING HEAD BEARING CUP INSTALLER

1. See Figure 2-79. Obtain STEERING HEAD BEARING CUP INSTALLER (Part No. HD-39302). Proceed as follows:
 a. Start upper bearing cup into top of steering head with the beveled side facing outboard.
 b. Fit smaller OD of installer tool into upper bearing cup.
 c. Slide forcing screw through installer tool and bearing cup until threaded end exits bottom of steering head.
 d. Sparingly apply graphite lubricant to threads of forcing screw.
 e. With the beveled side facing outboard, slide lower bearing cup up forcing screw.
 f. Slide second half of installer tool up forcing screw fitting smaller OD into lower bearing cup.
 g. Install Nice bearing, flat washers and hex nut onto forcing screw.
 h. See Figure 2-80. Tighten hex nut by hand until assembly is square and snug.
 i. While holding head of forcing screw, turn hex nut to simultaneously draw both upper and lower bearing cups into steering head. Continue turning hex nut until cups makes contact with counterbores.
 j. Disassemble and remove tool.
2. Install **new** dust shield on stem.
3. Pack **new** bearing cones with Harley-Davidson SPECIAL PURPOSE GREASE, Part No. 99857-97.
4. With the tapered side up, install bearing cone over stem. Lightly press on bearing cone until it bottoms against dust shield.
5. Insert stem of lower fork bracket up into steering head.
6. Install upper bearing cone with the tapered side down.
7. Install **new** dust shield until flush with top of steering head.
8. Install bearing adjuster nut onto stem.
9. Snug adjuster nut until bearing play is taken up and stem turns freely. Overtightening nut will cause excessive bearing wear.
10. Install upper fork bracket.

NOTE

The washer under the fork stem nut is a special hardened material. Never replace this washer with a common flat washer. Doing so may allow the fork stem nut to loosen resulting in loss of steering control.

11. Install hardened flat washer and stem nut.
12. Tighten stem nut to 70-80 ft-lbs (95-109 Nm).

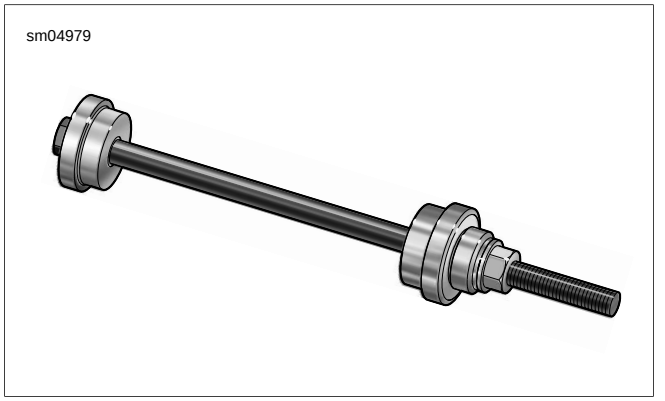


Figure 2-79. Steering Head Bearing Cup Installer (Part No. HD-39302)

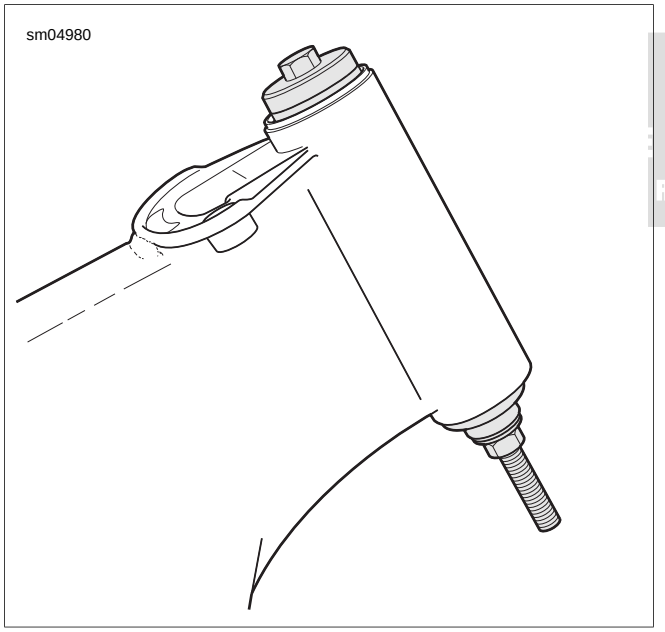


Figure 2-80. Install Steering Head Bearing Cups

13. Connect ignition switch [33], left handlebar switch [24], right handlebar switch [22] and twist grip sensor jumper harness [204] connectors. On fairing equipped motorcycles, connect interconnect harness ground socket terminal to spade contact at front of upper fork bracket (left side).
14. Install front forks. See 2.19 FRONT FORK.
15. Attach brake line bracket to bottom of lower fork bracket. Verify that brake lines to calipers are equal distance from the left and right fork sliders. Tighten screw to 120-180 **in-lbs** (13.6-20.3 Nm).
16. **FLTR:** Install air baffle to back of lower fork bracket. Tighten screws to 120-144 **in-lbs** (13.6-16.3 Nm).
17. Assemble motorcycle as follows:
 a. **FLHR/C:** Install headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
 b. **FLHX, FLHT/C/U:** Install radio (storage box on FLHT), outer fairing and auxiliary lamp bracket. See 7.33 ADVANCED AUDIO SYSTEM, 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 7.13 AUXILIARY LAMPS AND BRACKETS, respectively.
 c. **FLTR:** Install instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.

⚠WARNING

Properly adjust fork stem bearings. Improper adjustments affect stability and handling, which could result in death or serious injury. (00301a)

18. Adjust bearings. See 1.21 STEERING HEAD BEARINGS.

CHECK FOR AIR LEAKS

PART NUMBER	TOOL NAME
HD-34633A	AIR SUSPENSION PUMP AND GAUGE

NOTE

Remove and replace components as necessary to access air suspension system components.

1. Remove left side saddlebag. See 2.29 SADDLEBAGS.
2. Adjust air pressure using AIR SUSPENSION PUMP AND GAUGE (Part No. HD-34633A). See 1.18 SUSPENSION ADJUSTMENTS. Remove the gauge and wait overnight.
3. Recheck air pressure. If no leakage is observed, install protective cap and saddelbag. If a loss of 5-10 psi (34.5-68.9 kPa) is noted, then proceed to "Compression System" below.

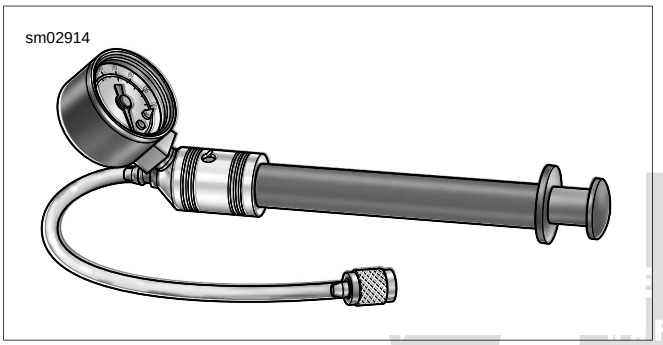


Figure 2-81. Air Suspension Pump and Gauge (Part No. HD-34633A)

Compression Fitting

4. Pressurize rear air suspension system.
5. Spray or brush a light film of soapy water on the compression fitting at the top of each shock absorber. If no leakage is observed, move to "Air Valve System". If leakage is noted, proceed as follows:
 a. Depress pin in valve to bleed air from shocks. To purge lines of any oil, add 3-5 psi (20.7-34.5 kPa) before releasing air.
 b. See inset of Figure 2-83. Depress collar on compression fitting and pull out air tube. Inspect the tube end for burrs or damage. If either condition is observed, snip off the end of the tube and insert it back into the compression fitting until it bottoms. Gently tug on tube to verify that it is locked in place.
 c. Pressurize rear air suspension system and check for leaks. If leakage continues, proceed to step 5(d).
 d. Depress collar on compression fitting and pull out air tube. Remove compression fitting from shock absorber.
 e. Apply PIPE SEALANT WITH TEFLON to the threads of a **new** compression fitting and install in shock absorber.
 f. Insert air tube into the compression fitting until it bottoms. Gently tug on tube to verify that it is locked in place.
 g. Pressurize rear air suspension system and check for leaks. If no leakage is observed, install protective cap and saddlebag. If leakage continues, proceed to "Air Valve Assembly".

Air Valve Assembly

6. Spray or brush a light film of soapy water into the valve head and where the air tubes exit the air inlet tee. If

leakage is not observed at either location, move to "Air Tubes". If leakage is noted, proceed as follows:

a. If leakage is at the air inlet tee, proceed to step 6(b). If leakage is at the valve head, proceed to step 6(e).

b. Depress pin in valve to bleed air from shocks. To purge lines of any oil, add 3-5 psi (20.7-34.5 kPa) before releasing air.

c. Depress collar on air inlet tee and pull out air tube. Inspect the tube end for burrs or damage. If either condition is observed, snip off the end of the tube and insert it back into the air inlet tee until it bottoms. Gently tug on tube to verify that it is locked in place. Repeat step with remaining tube.

d. Pressurize rear air suspension system and check for leaks. If no leakage is observed, move to step 8. If leakage continues, proceed to step 6(e).

e. Using a valve core tool, verify that valve core is properly tightened. If leakage continues, proceed to step 6(f).

f. Depress pin in valve to bleed air from shocks. To purge lines of any oil, add 3-5 psi (20.7-34.5 kPa) before releasing air.

g. See Figure 2-83. Remove hex nut from valve head.

h. See Figure 2-82. Push on valve head to free air valve assembly from mounting bracket.

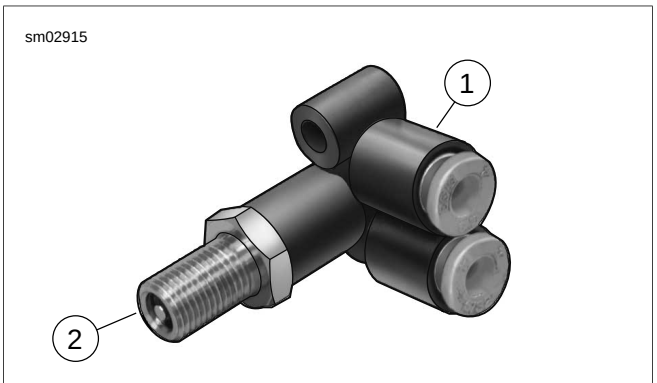
i. Depress collars on air inlet tee and pull out air tubes.

j. Insert air tubes into air inlet tee of **new** air valve assembly.

k. From inboard side, insert valve head through hole in mounting bracket. Install hex nut on valve head (flat side facing inboard). Tighten nut to 40-50 **in-lbs** (4.5-5.6 Nm).

l. Pressurize rear air suspension system and check for leaks.

m. If no leakage is observed, move to step 8. If leakage continues, install old air valve assembly and proceed to step 7.



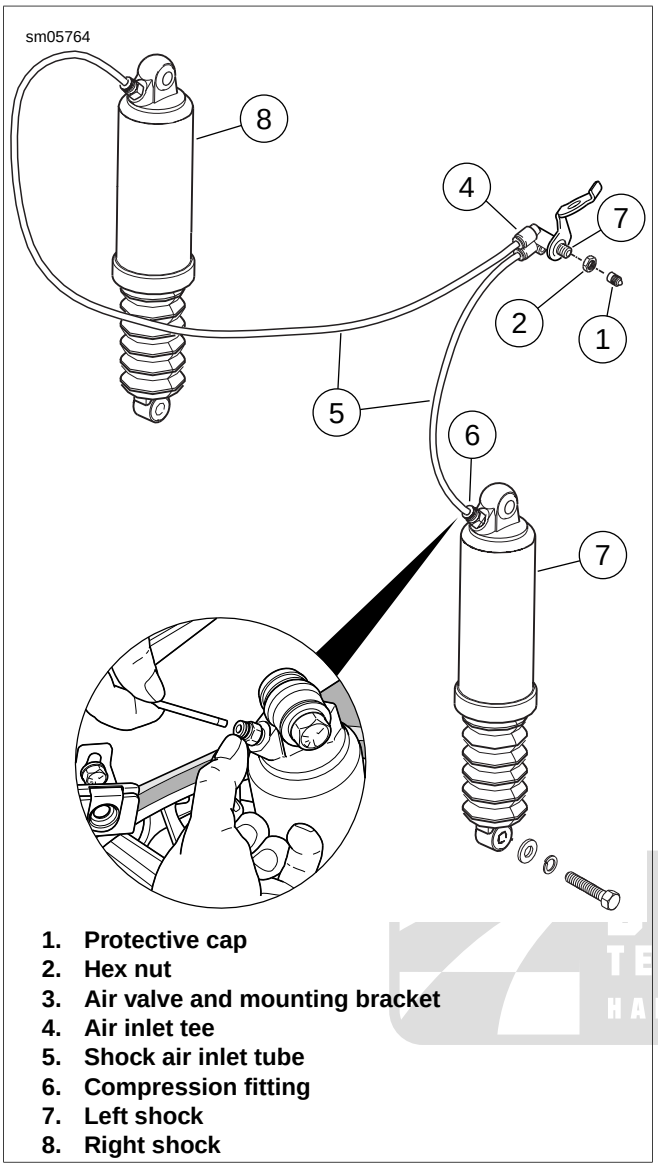
1. **Air inlet tee**
2. **Valve head**

Figure 2-82. Air Valve Assembly

Air Tubes

7. Inspect air tubes for kinks, cuts, holes, chafing or other damage that may result in air leaks. If tube replacement is necessary, proceed as follows:
 a. Remove seat. See 2.28 SEAT.
 b. Depress pin in valve to bleed air from shocks. To purge lines of any oil, add 3-5 psi (20.7-34.5 kPa) before releasing air.
 c. See Figure 2-83. Depress collars on air inlet tee and pull out air tubes. Remove opposite end of tubes from compression fittings.
 d. Cut bulk tube to proper length.
 e. Insert **new** tubes into air inlet tee. Install opposite end of tubes into compression fittings.
 f. Pressurize rear air suspension system.
 g. Install seat. See 2.28 SEAT.
8. Install protective cap on air valve.
9. Install left side saddlebag. See 2.29 SADDLEBAGS.

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1. **Protective cap**
2. **Hex nut**
3. **Air valve and mounting bracket**
4. **Air inlet tee**
5. **Shock air inlet tube**
6. **Compression fitting**
7. **Left shock**
8. **Right shock**

Figure 2-83. Rear Air Suspension System

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REAR SHOCK ABSORBERS 2.23

REMOVAL

PART NUMBER	TOOL NAME
HD-34633	AIR SUSPENSION PUMP AND GAUGE

NOTE

If replacing both shock absorbers, remove and install one at a time.

1. Place the motorcycle on a hydraulic center stand with the rear wheel raised off the ground.
2. Remove saddlebags. See 2.29 SADDLEBAGS.

⚠WARNING

Use caution when bleeding air from the suspension. Moisture combined with lubricant may leak onto the rear wheel, tire and/or brake components and adversely affect traction, which could result in death or serious injury. (00084a)

3. Using the no-loss AIR SUSPENSION PUMP AND GAUGE (Part No. HD-34633), add 3-5 psi (20.7-34.5 kPa) to purge lines of any oil.
4. Bleed air from suspension system.
5. Depress collar on compression fitting to release air tube.
6. Remove the upper shock absorber mounting bolt, lockwasher and flat washer.
7. Remove the lower mounting bolt, lockwasher and flat washer. Remove the shock absorber assembly from the motorcycle.

NOTE

Never lay the shock absorber down. Always keep the shock absorber upright in a fully vertical position. Laying the shock absorber down with the air line removed can cause the oil to drain out through the compression fitting. Any loss of oil requires replacement of the shock absorber.

CLEANING AND INSPECTION

1. Examine the rubber mounting bushings for cracks or wear. Examine the shock for leaks. The unit should not leak and should compress slightly easier than it extends. Compare the action of the shock with a new one to judge if it is worn. Replace the shock if necessary.
2. Clean and examine the shock mounting hardware. Replace parts that are worn or damaged.

DISASSEMBLY AND ASSEMBLY

NOTES

- *Air shocks are not repairable. Replace the shocks if damaged, worn or any sign of leakage is observed.*
- *If the compression fittings were removed, apply PIPE SEALANT WITH TEFLON to the threads before assembly.*

INSTALLATION

NOTE

Never lay the shock absorber down. Always keep the shock absorber upright in a fully vertical position. Laying the shock absorber down with the air line removed can cause the oil to drain out through the compression fitting. Any loss of oil requires replacement of the shock absorber.

1. Apply two or three drops of LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (blue) to threads of each mounting bolt.
2. Install lower shock mounting bolt, lockwasher and flat washer. Tighten bolt to 35-40 ft-lbs (47.5-54.2 Nm).
3. Install upper shock mounting bolt, lockwasher and flat washer. Tighten bolt to 35-40 ft-lbs (47.5-54.2 Nm).
4. Insert air tube into compression fitting until it bottoms. Gently tug on tube to verify that it is locked in place.
5. Pressurize rear air suspension system and check for leaks. See 1.18 SUSPENSION ADJUSTMENTS and 2.22 REAR AIR SUSPENSION, respectively.
6. Install saddlebags. See 2.29 SADDLEBAGS, Installation.

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REAR FORK 2.24

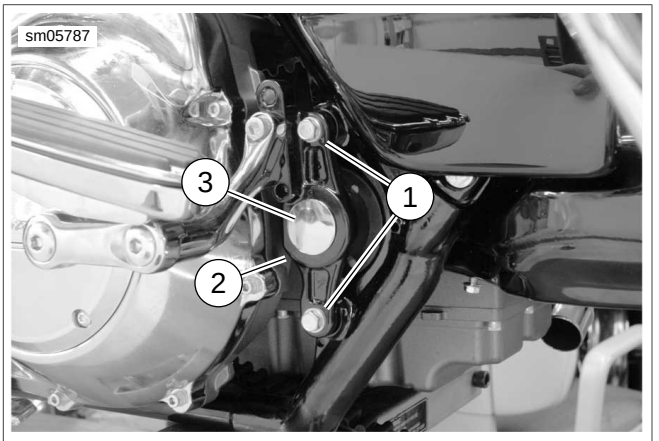
REMOVAL

1. Place the motorcycle on a hydraulic center stand. Slide a block of wood between the oil pan and frame cross member to support the weight of the transmission once the pivot shaft is removed.
2. Remove rear wheel. See 2.5 REAR WHEEL.
3. Remove caliper and bracket from anchor weldment on rear fork.
4. Remove belt guard from bottom of left side fork.
5. Loosen both lower shock mounting bolts but do not remove at this time.
6. See Figure 2-84. Remove two bolts (1) to free rear fork bracket (2) with foot rest from left side of motorcycle frame.
7. Release rear brake line hose and rear wheel speed sensor (if ABS equipped) from cable clips on right side of rear fork.
8. Remove decorative chrome plug from right side.

NOTE

For best results, use a air impact wrench to remove the right-side nut. Applying heat to the right-side nut may also improve removal. If the left-side nut loosens first, remove left-side mount and use double nuts to hold pivot shaft while removing right-side nut.

9. See Figure 2-85. Hold left side nut and remove right side nut (1) from end of pivot shaft. Remove cup washer.
10. Using a suitable drift, tap pivot shaft toward left side of motorcycle.
11. See Figure 2-86. Pull pivot shaft assembly with nut, cup washer, rubber mount and outer spacer out of transmission mount and left side fork.
12. Remove lower shock absorber bolts and work rear fork free of transmission mount and rear fork brackets.
13. Remove outer spacer from right side fork tube.
14. Remove rubber mount from right side.



1. **Bolts**
2. **Fork bracket**
3. **Chrome plug**

Figure 2-84. Rear Fork Bracket

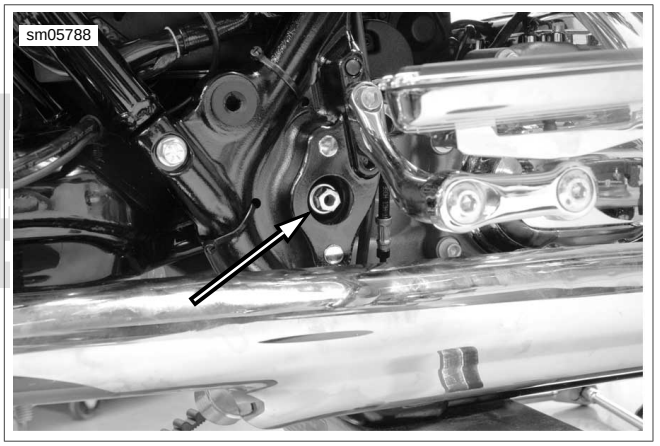
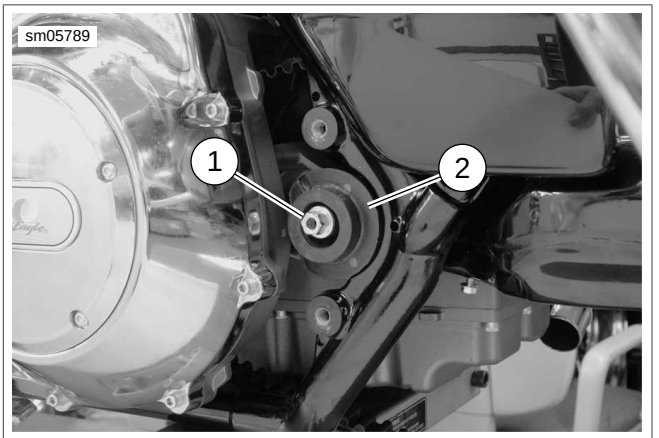


Figure 2-85. Right Side Mount



1. **Nut, pivot shaft**
2. **Left mount**

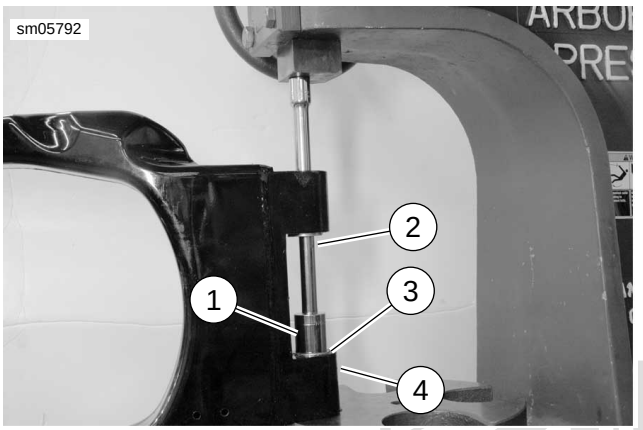
Figure 2-86. Left Mount and Pivot Shaft Assembly

DISASSEMBLY AND ASSEMBLY

PART NUMBER	TOOL NAME
HD-45327	REAR FORK BEARING INSTALLER

Bearing Removal

1. See Figure 2-87. Select a socket (1) slightly smaller than the bearing spacer and a socket extension (2) long enough to allow pressing through upper bearing. Slide socket extension through the brake side bearing and install socket on extension.
2. Support the fork (4) in a press with brake anchor weldment on top. Verify that assembly is square and the bearing bore is completely vertical.



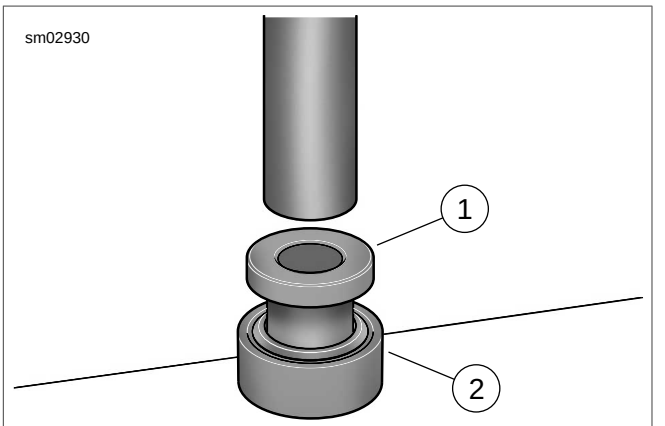
1. **Socket**
2. **Extension**
3. **Bearing/spacer assembly**
4. **Rear fork**

Figure 2-87. Remove Rear Fork Bearing

3. Center socket extension under ram and press bearing/spacer assembly (3) from rear fork.
4. Remove tools from rear fork. Turn fork over and press out brake side bearing in same manner.
5. If bearings are to be replaced with new, press bushings out and retain for later use.

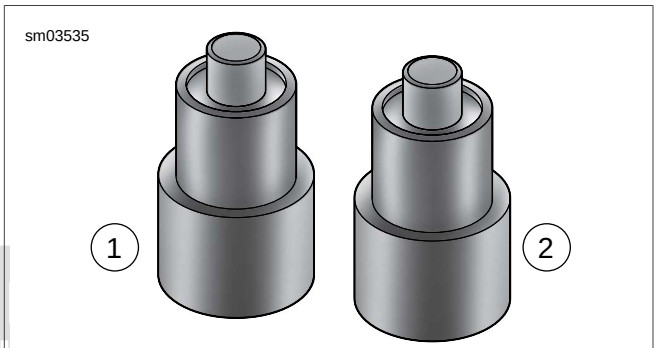
Bearing Installation

1. Obtain **new** rear fork bearings. Bearings and spacers must be assembled before installation. Proceed as follows:
 a. Place bearing flat on suitable press plate.
 b. See Figure 2-88. With the collar topside, start spacer into bearing.
 c. Press spacer until it bottoms against press plate.



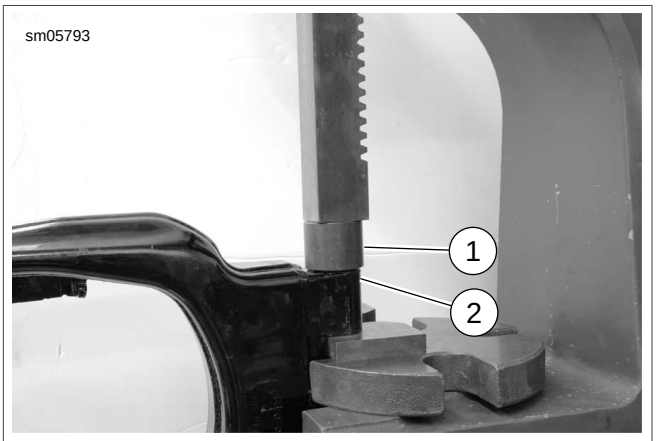
1. **Spacer**
2. **Bearing**

Figure 2-88. Press Spacer into Bearing



1. **Drive side driver**
2. **Brake side driver**

Figure 2-89. Rear Fork Bearing Installer



1. **Bearing installer**
2. **Fork tube**

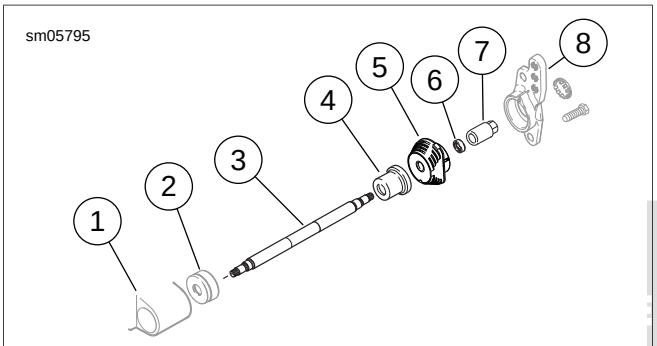
Figure 2-90. Install Rear Fork Bearing

2. Coat the bearing bores in the rear fork with a light coat of Special Purpose Grease, Part No. 99857-97.

3. Support fork squarely on press bed with the brake anchor weldment on top.
4. Insert bearing into fork assembly with spacer down.
5. See Figure 2-90. Using REAR FORK BEARING INSTALLER (Part No. HD-45327) (1) stamped "Brake Side", center driver under ram and press on bearing until shoulder on tool makes contact with fork tube (2).
6. Remove tool and turn rear fork over. Repeat process with remaining bearing using tool stamped "Drive Side". Press bearing until it bottoms. Shoulder on tool will **not** make contact with fork tube.

Pivot Shaft Disassembly

1. See Figure 2-91. Remove nut (7) by using jam nuts on the opposite end of shaft (3).
2. Remove cup washer (6), rubber mount (5) and outer spacer (4).
3. Remove jam nuts from pivot shaft.



1. **Rear fork assembly**
2. **Bearing/spacer assembly**
3. **Pivot shaft**
4. **Outer spacer**
5. **Mount**
6. **Cup washer**
7. **Nut**
8. **Fork bracket**

Figure 2-91. Pivot Shaft Components

INSTALLATION

1. See Figure 2-92. With the slot on the outboard side between the twelve and one o'clock positions, install rubber mount on inner-right side of frame. Be sure that index tab in mount cavity fully engages slot in rubber mount.
2. Place outer spacer into right side fork tube.
3. Move the fork into approximate position and loosely install lower shock absorber bolts.
4. Work the rear fork into position between the transmission mount and the right-rear fork mount. If necessary, carefully tap fork into position using a rubber mallet.
5. Coat pivot shaft with anti-seize lubricant. Avoid getting anti-seize on threads of pivot shaft.
6. See Figure 2-86. Slide pivot shaft from left side of motorcycle through left side fork and transmission mount. Guide end of pivot shaft through hole in right rubber mount.
7. With larger OD outboard, slide outer spacer (4) onto left end of pivot shaft (3) until seated on shoulder of shaft.
8. Install rubber mount (5) with the flat side inboard toward outer spacer.
9. Install cup washer (6) with the concave side facing in toward the rubber mount.
10. See Figure 2-84. Rotate the left rubber mount so the slot is between the eleven and twelve o'clock positions. Install left side fork bracket (2) fitting index tab into rubber mount slot.
11. Apply two drops of Loctite Medium Strength Threadlocker 243 (blue) to threads of fork bracket bolts (1) and secure left side fork bracket. Tighten bolts to 55-65 ft-lbs (74.6-88.1 Nm). Remove chrome plug (3) from left side.
12. With the concave side inboard, slide cup washer onto end of pivot shaft.
13. See Figure 2-85. Apply two drops of Loctite Medium Strength Threadlocker 243 (blue) to threads of both pivot shaft nuts and install on pivot shaft.
14. Hold one nut and tighten other nut to 55-66 ft-lbs (74.6-89.5 Nm).
15. Verify that rear fork assembly moves freely.
16. Install chrome plugs.
17. Remove lower shock mounting bolts and apply two or three drops of Loctite Medium Strength Threadlocker 243 (blue) to threads. Install bolts and tighten to 35-40 ft-lbs (47-54 Nm).
18. Install belt guard.
19. Seat caliper bracket on anchor weldment of rear fork.
20. Capture rear brake line hose in two cable clips at top of right side fork. Rear cable clip also captures rear wheel speed sensor cable on ABS equipped motorcycles.
21. Install rear wheel. See 2.5 REAR WHEEL.

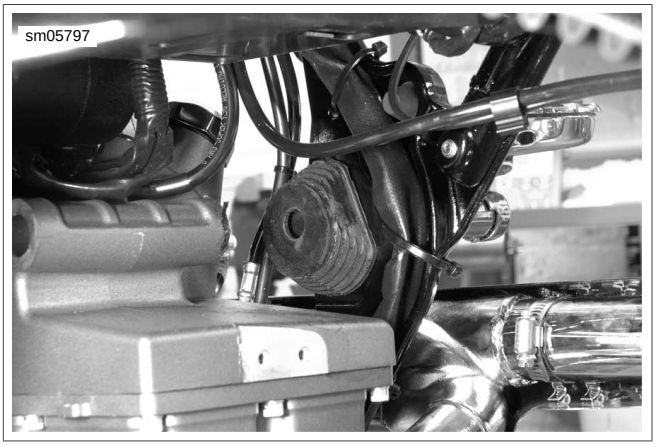
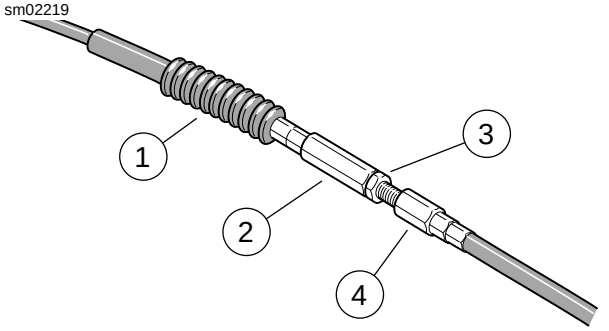


Figure 2-92. Right-Side Mount

CLUTCH CABLE 2.25

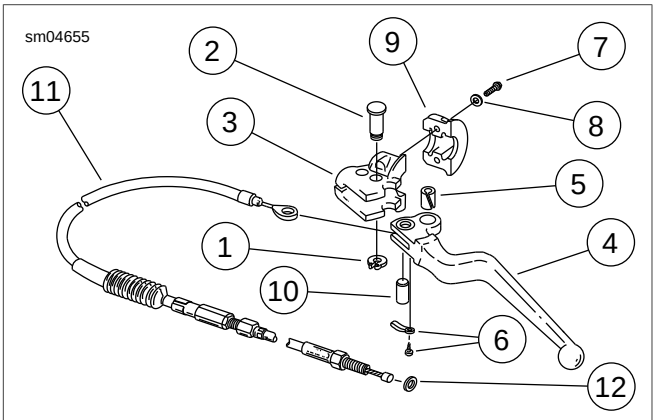
REMOVAL

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Remove right side exhaust system. See 4.19 EXHAUST SYSTEM.
3. See Figure 2-93. Slide rubber boot off clutch cable adjuster. Loosen jam nut. Back away from cable adjuster. Move adjuster toward jam nut to introduce free play at hand lever.
4. See Figure 2-94. Remove retaining ring from pivot pin groove at bottom of clutch lever bracket. Remove pivot pin.
5. Remove clutch hand lever from clutch lever bracket. If necessary, remove handlebar clamp from clutch lever bracket.
6. Remove anchor pin and clutch cable eyelet from clutch hand lever.
7. Remove the magnetic drain plug at the bottom right side of the oil pan and drain the transmission lubricant into a suitable container. Remove the filler plug/dipstick.
8. Remove and disassemble clutch release cover. Remove and discard gasket. See 6.5 CLUTCH RELEASE COVER.



1. **Rubber boot**
2. **Cable adjuster**
3. **Jam nut**
4. **Cable end**

Figure 2-93. Clutch Cable Adjuster



1. **Retaining ring**
2. **Pivot pin**
3. **Clutch lever bracket**
4. **Hand lever**
5. **Bushing**
6. **Anti-rattle spring and screw**
7. **Screw**
8. **Flat washer**
9. **Handlebar clamp**
10. **Anchor pin**
11. **Clutch cable**
12. **O-ring**

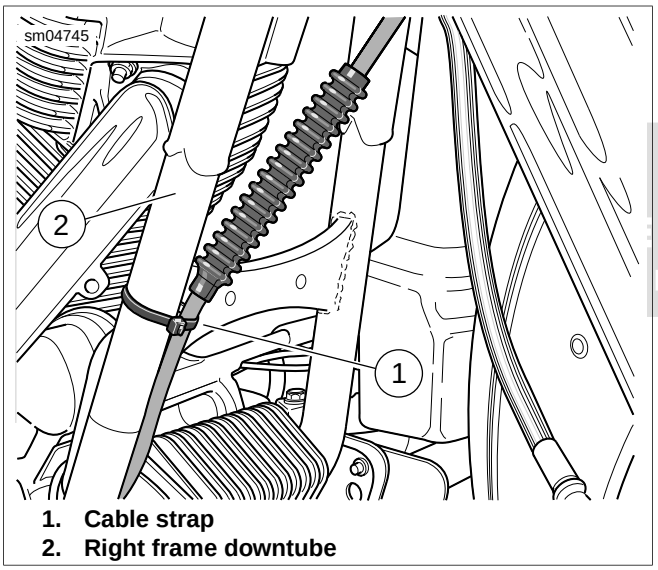
Figure 2-94. Clutch Hand Lever Assembly

9. See Figure 2-95. Cut cable strap to free clutch cable from right frame downtube. Continue as follows:
 a. **FLHR/C:** See Figure 2-96. Remove acorn nut to release P-clamp from stud in upper fork bracket. Remove clutch cable from P-clamp.
 b. **FLHX, FLHT/C/U:** See Figure 2-97. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U. Cut cable strap to release clutch cable from left fairing bracket.
 c. **FLTR:** Release clutch cable from cable clip anchored in hole on left side of instrument nacelle.
10. Remove clutch cable from motorcycle.

INSTALLATION

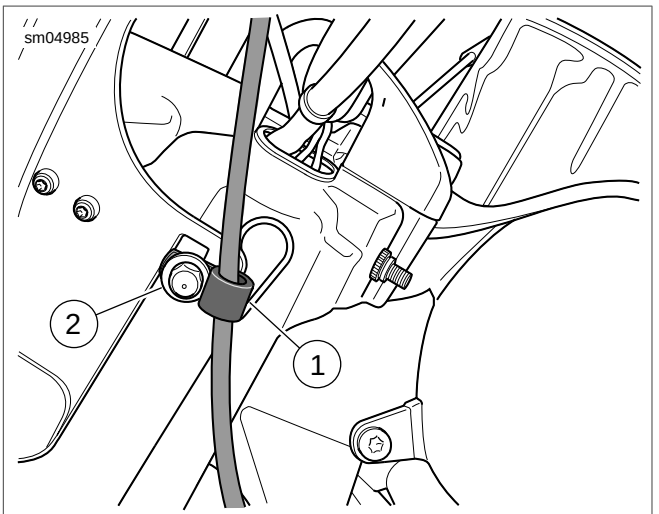
1. See Figure 2-94. Insert clutch cable eyelet into groove of clutch hand lever aligning eyelet with hole without bushing. Insert anchor pin through lever and eyelet.
2. Insert lever into groove of clutch lever bracket fitting sleeve at end of cable housing into bore on inboard side of bracket.
3. Align hole in hand lever with hole in bracket and install pivot pin. Install retaining ring in pivot pin groove.
4. See Figure 2-94. If removed, secure handlebar clamp to clutch lever bracket. Starting with the top screw, tighten screws to 60-80 **in-lbs** (6.8-9.0 Nm).

5. Start clutch cable routing as follows:
 a. **FLHR/C:** See Figure 2-96. Capture clutch cable in P-clamp. Slide P-clamp on stud in upper fork bracket and install acorn nut. On left side of steering head, run cable downward between engine guard and front of left frame downtube.
 b. **FLHX, FLHT/C/U:** See Figure 2-97. Feed clutch cable through grommet on left side of inner fairing. Route cable on inboard side of left fairing bracket between upper and lower wings of radio (or storage box) support bracket. Cable strap clutch cable to left fairing bracket using oblong hole at this location. Run the cable downward along left side of steering head, and then between engine guard and front of left frame downtube. Install the outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
 c. **FLTR:** Capture clutch cable in cable clip and anchor clip in hole on left side of instrument nacelle. Run cable forward and then rearward beneath instrument nacelle following left side of steering head. Run cable downward between engine guard and front of left frame downtube.



1. **Cable strap**
2. **Right frame downtube**

Figure 2-95. Clutch Cable Routing (Right Side View)



1. **P-clamp**
2. **Acorn nut**

Figure 2-96. FLHR/C Clutch Cable Routing (Left Side View)

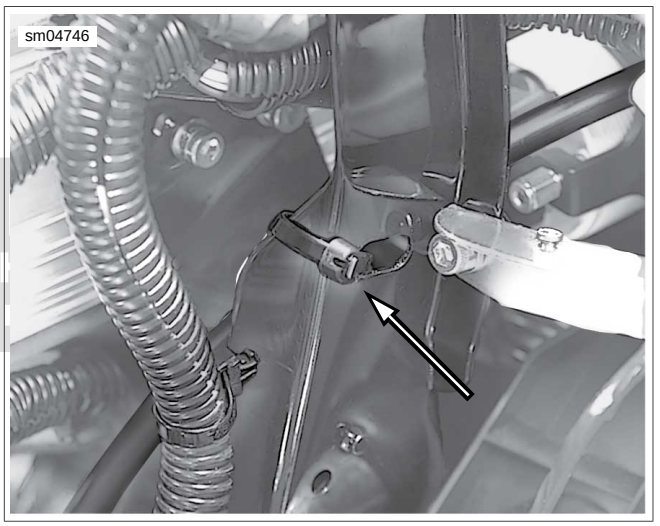


Figure 2-97. Secure Clutch Cable to Fairing Bracket

6. **All Models:** See Figure 2-95. Continue downward progression while crossing to right side of motorcycle and then run cable between outboard side of voltage regulator and inboard side of right frame downtube. Secure clutch cable to downtube through hole in crossbrace using cable strap. Following inboard side of frame downtube, route cable between bottom of cam cover and top of lower frame tube to area of clutch release cover.
7. Assemble and install clutch release cover with new gasket. See 6.5 CLUTCH RELEASE COVER.
8. Tighten clutch cable fitting to 90-120 **in-lbs** (10.2-13.6 Nm).
9. Check O-ring on the transmission drain plug for tears, cuts or general deterioration. Replace as necessary.
10. Install transmission drain plug. Tighten to 14-21 ft-lbs (19-28 Nm).

11. Fill transmission. See 1.8 TRANSMISSION LUBRICANT.

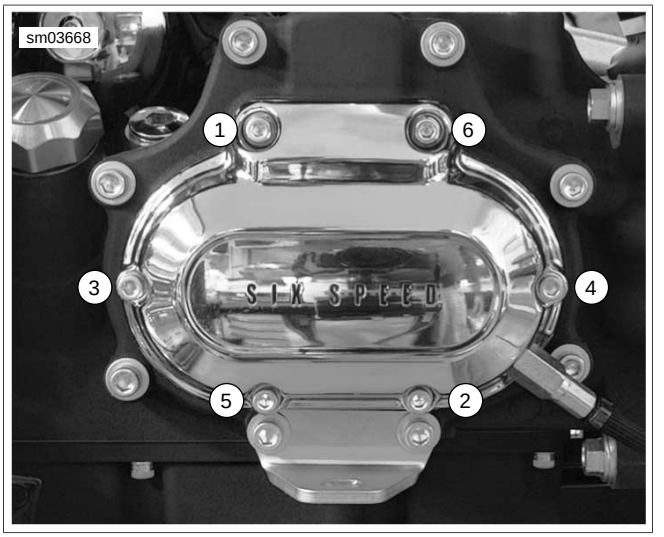


Figure 2-98. Clutch Release Cover Torque Sequence (Short Screws at Locations 1 and 6)

12. Adjust the clutch cable. See 1.11 CLUTCH.
13. Install right side exhaust system. See 4.19 EXHAUST SYSTEM.
14. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

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ADJUSTMENT

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Gain access to upper handlebar clamp:
 a. **FLHR/C:** See Figure 2-99 and Figure 2-100. Remove decorative plate from handlebar clamp shroud.
 b. **FLHX, FLHT/C/U:** Remove fairing cap. See 2.38 FAIRING CAP: FLHX, FLHT/C/U.
 c. **FLTR:** Remove instrument bezel. See 2.42 INSTRUMENT BEZEL: FLTR.
3. Loosen rear screws on the upper handlebar clamp. On FLTR models, loosen the front screws instead.
4. Position handlebars for rider posture and comfort.
5. To be sure that the handlebars are centered, verify that the knurled area on the outboard side of the left side handlebar clamp is equal to that on the right side.
6. Snug upper handlebar clamp screws.
7. Slowly turn handlebars to the full right fork stop and then the full left fork stop to be sure there is no contact with the fuel tank. If contact occurs and handlebars are properly aligned, raise handlebars as necessary until the proper clearance is obtained.
8. Tighten the upper handlebar clamp screws to 16-20 ft-lbs (21.7-27.1 Nm).
9. Reassemble:
 a. **FLHR/C:** See Figure 2-99. Install decorative plate onto handlebar clamp shroud.
 b. **FLHX, FLHT/C/U:** Install fairing cap. See 2.38 FAIRING CAP: FLHX, FLHT/C/U.
 c. **FLTR:** Install instrument bezel. See 2.42 INSTRUMENT BEZEL: FLTR.
10. If necessary, adjust left and right handlebar switch controls as follows:
 a. Loosen two screws securing handlebar clamp to clutch lever bracket (left) or master cylinder reservoir (right).
 b. Position switch controls for rider posture and comfort.
 c. Beginning with top screw, tighten screws securing handlebar clamp to clutch lever bracket to 72-108 **in-lbs** (8-12 Nm).
 d. Beginning with top screw, tighten screws securing handlebar clamp to master cylinder reservoir to 72-80 **in-lbs** (8-9 Nm).
11. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.



Figure 2-99. Remove Decorative Plate (FLHR/C)



Figure 2-100. Loosen Upper Handlebar Clamp Screws (FLHR/C)

REMOVAL

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Remove or disconnect twist grip sensor jumper harness depending upon whether the handlebar is being replaced or just removed. See 4.10 TWIST GRIP SENSOR.
3. Place blanket or protective cover over front of fuel tank to protect against scratches or other damage.

4. Gain access to upper handlebar clamp:
 a. **FLHR/C:** Remove handlebar clamp shroud. See 2.47 HEADLAMP NACELLE: FLHR/C.
 b. **FLHX, FLHT/C/U:** Remove fairing cap. See 2.38 FAIRING CAP: FLHX, FLHT/C/U. Remove radio (or storage box). See 7.33 ADVANCED AUDIO SYSTEM.
 c. **FLTR:** Remove instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.
5. Remove right and left handlebar switch controls. See 7.40 HANDLEBAR SWITCH ASSEMBLIES and 7.40 HANDLEBAR SWITCH ASSEMBLIES, respectively.
6. Remove upper handlebar clamp screws. Remove upper handlebar clamp and handlebar.

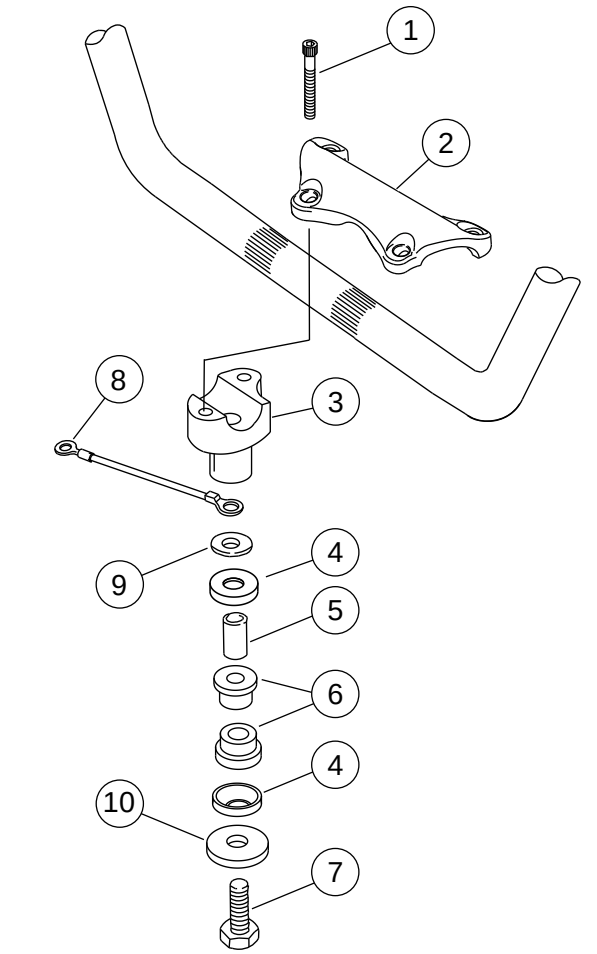
INSTALLATION

1. Place handlebars on lower handlebar clamps. Install upper handlebar clamp and loosely install clamp screws.
2. Verify that the handlebars are centered, and snug upper handlebar clamp screws.
3. Slowly turn handlebars to the full right fork stop and then the full left fork stop to be sure there is no contact with the fuel tank. If contact occurs and handlebars are properly aligned, raise handlebars as necessary until the proper clearance is obtained.
4. Tighten upper handlebar clamp screws as follows:
 a. Tighten front screws until upper and lower handlebar clamps make contact.
 b. Tighten rear screws to 16-20 ft-lbs (21.7-27.1 Nm).
 c. Tighten front screws to 16-20 ft-lbs (21.7-27.1 Nm).

NOTE

A slight gap will exist between the upper and lower clamps at the rear of the handlebars after tightening.

5. Install left hand grip, if removed. See 2.26 HANDLEBARS, Left Hand Grip.
6. Install right and left handlebar switch controls. See 7.40 HANDLEBAR SWITCH ASSEMBLIES and 7.40 HANDLEBAR SWITCH ASSEMBLIES, respectively.
7. Reassemble:
 a. **FLHR/C:** Install handlebar clamp shroud. See 2.47 HEADLAMP NACELLE: FLHR/C.
 b. **FLHX, FLHT/C/U:** Install fairing cap. See 2.38 FAIRING CAP: FLHX, FLHT/C/U. Install radio (or storage box). See 7.33 ADVANCED AUDIO SYSTEM.
 c. **FLTR:** Install instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.
8. Install or connect twist grip sensor jumper harness depending upon whether the handlebar was replaced or just removed. See 4.10 TWIST GRIP SENSOR.
9. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
10. Turn ignition/light key switch to IGNITION and test each handlebar switch for proper operation.
11. Apply front brake hand lever to test operation of brake lamp.



1. **Screw**
2. **Upper clamp**
3. **Lower clamp**
4. **Cup washer**
5. **Spacer**
6. **Rubber bushing**
7. **Bolt**
8. **Ground cable (left clamp only)**
9. **Flat washer (right clamp only)**
10. **Large flat washer (right clamp only)**

Figure 2-101. Handlebar Clamp Assemblies

LEFT HAND GRIP

Removal

1. Remove left handlebar switch controls. See 7.40 HANDLEBAR SWITCH ASSEMBLIES.
2. Use a sharp blade to carefully cut rubber and then peel off handlebar.
3. Thoroughly clean handlebar to remove all residual adhesive.

Installation

1. Obtain a **new** left hand grip and Harley-Davidson Adhesive (Part No. 99839-95). Apply a coat of the adhesive to the inside surface of the grip 1.0 in. (25.4 mm) from the open end. Apply a coat to the end of the handlebar.

NOTE

If the left hand grip is patterned, align it with the pattern on the right grip with the throttle in the fully closed position.

2. Immediately push grip completely onto end of handlebar using a twisting motion. Do not hesitate when installing grip or adhesive may dry before installation is complete.
3. Let 6-8 hours elapse at 70 °F (21 °C) to allow adhesive to fully cure.
4. Install left handlebar switch controls. See 7.40 HANDLEBAR SWITCH ASSEMBLIES.

RUBBER MOUNTS

NOTE

For complete disassembly of the handlebar clamp assemblies and/or to replace the rubber mounts, proceed as follows.

General

1. See Figure 2-101. Loosen bolts (7) securing lower clamps (3) to upper fork bracket.
2. Remove handlebars from lower clamps. See 2.26 HANDLEBARS, Removal.

Removal

1. Remove bolts (7), washer (10) and cup washers (4).
2. Remove lower handlebar clamp (3), flat washer (4) and cup washer from top of upper fork bracket.
3. Pull bushings (6) from fork bracket bore and spacers (5).
4. Discard bushings.

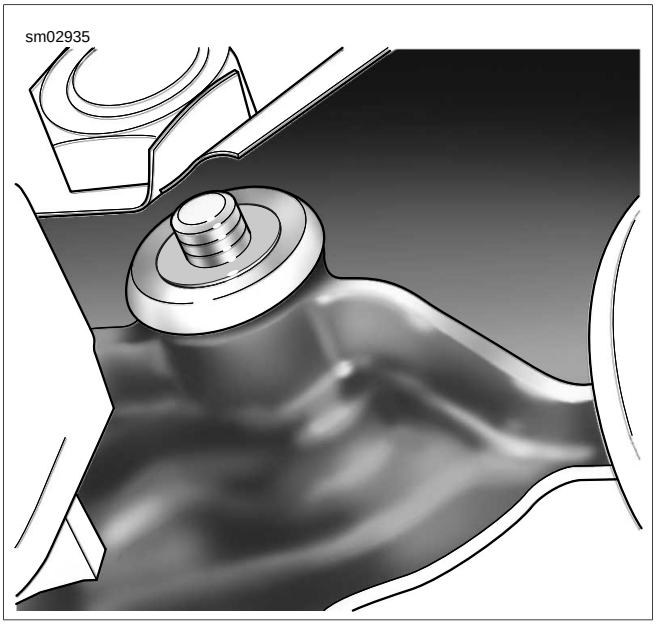


Figure 2-102. Remove Flat Washer and Upper Cup Washer (Right Side)

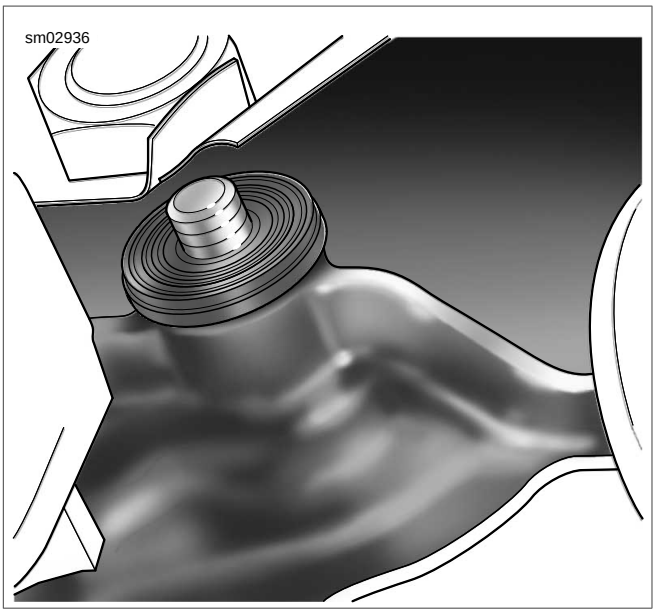


Figure 2-103. Remove Upper Bushing (Right Side)

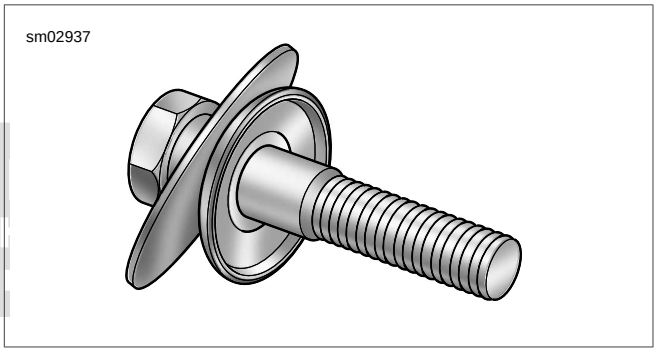


Figure 2-104. Remove Bolt, Large Washer, and Lower Cup Washer (Right Side)

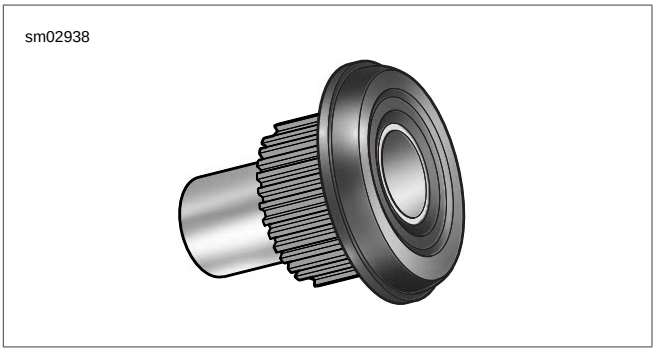


Figure 2-105. Remove Spacer from Lower Bushing

Installation

1. See Figure 2-105. Insert spacers into **new** bushings until flush with outboard side of collar.
2. Insert bushing into bore at bottom of upper fork bracket fitting collar of bushing over lip of boss.

3. See Figure 2-103. Insert bushing into bore.
4. Install large flat washer (right only) and cup washer on bolt. Insert bolt into bushing fitting concave side of cup washer over collar of bushing.
5. Install cup washer over threaded end of bolt fitting concave side over collar of bushing. Install ground wire ring terminal (left side) or small flat washer (right side).
6. Apply two or three drops of Loctite Medium Strength Threadlocker 243 (blue) to threads of bolt. Install lower handlebar clamp and turn bolt until snug.

Installation: General

1. Install handlebars and upper handlebar clamp. See 2.26 HANDLEBARS, Installation.
2. Tighten lower clamp bolts to 30-40 ft-lbs (40.7-54.2 Nm).
3. Complete assembly of motorcycle. See 2.26 HANDLEBARS, Installation.

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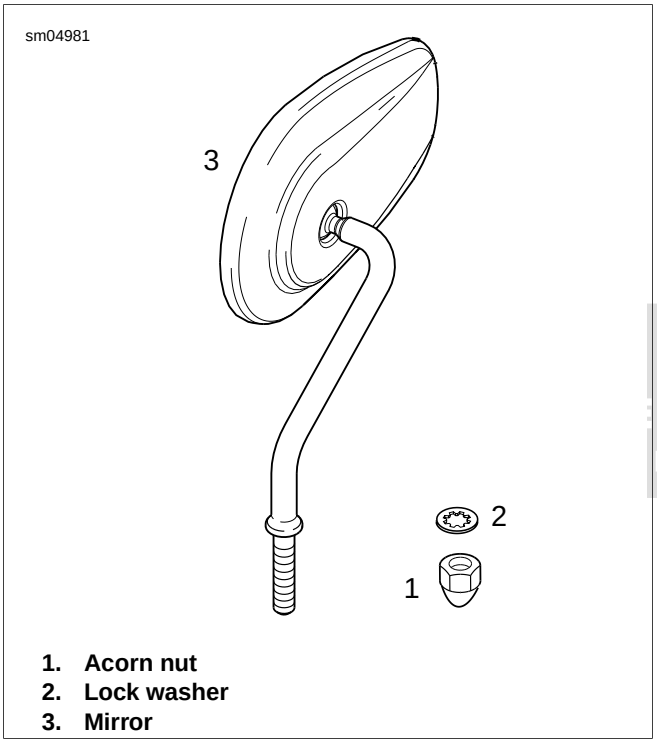
ALL MODELS EXCEPT FLHX

Removal

1. Remove acorn nut and lock washer.
2. See Figure 2-106. Remove mirror.

Installation

1. Insert threaded stem of mirror into hole in clutch or brake lever bracket.
2. Install lock washer and acorn nut.
3. Adjust mirror as necessary and tighten acorn nut to 60-96 **in-lbs** (6.8-10.8 Nm).



1. **Acorn nut**
2. **Lock washer**
3. **Mirror**

Figure 2-106. Mirror Assembly (All Models Except FLHX)

FLHX

Removal

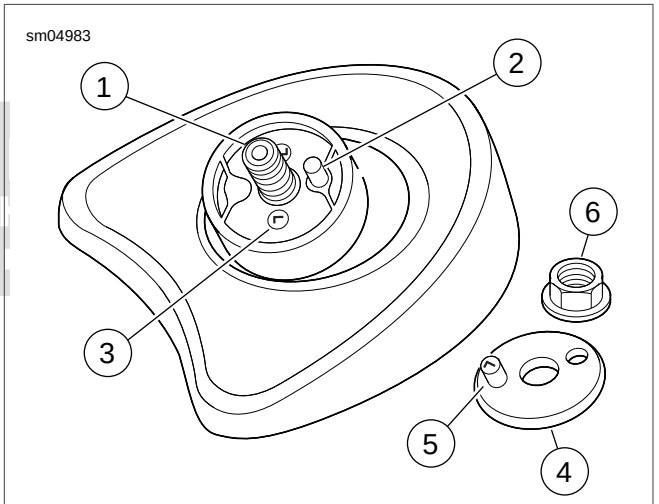
1. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
2. See Figure 2-107. Remove flange nut and plastic washer. Remove mirror.

Installation

1. See Figure 2-108. With the rounded side of the mirror on the outboard side (and the bar and shield logo right side up), insert threaded stud and index pin on swivel block through holes in inner fairing.



Figure 2-107. Remove Outer Fairing (FLHX)



1. **Threaded stud**
2. **Index pin**
3. **Swivel block stamp**
4. **Plastic washer**
5. **Stamped post**
6. **Flange nut**

Figure 2-108. Left Side Mirror Assembly (FLHX)

NOTE

The letters "L" or "R" are stamped on the swivel blocks to differentiate between left and right side mirrors.

2. With the post on the outboard side, place the plastic washer against the inner fairing engaging two holes in washer with threaded stud and index pin.

NOTE

The letters "L" or "R" are stamped on the posts to differentiate between left and right side washers.

3. See Figure 2-107. Install flange nut on threaded stud and tighten to 30-40 **in-lbs** (3.4-4.5 Nm).
4. Adjust mirror as necessary.
5. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

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SEAT: FLHT, FLTR, FLHX

Removal

CAUTION

Detach passenger seat strap before removing seat. Failure to do so can result in damage to rear fender paint. (00225a)

1. Open left side saddlebag.
2. See Figure 2-109. Remove screw to release passenger seat strap from seat strap bracket. A firm tug may be necessary to free end of strap from slot of seat strap bracket.
3. Draw free end of passenger seat strap to right side of motorcycle.
4. Remove screw to detach seat mounting bracket from top of rear fender.
5. See Figure 2-110. Push seat rearward to free slot from tongue on rear fuel tank bracket.

Installation

1. Place seat on frame.
2. See Figure 2-110. Firmly push front of seat downward and then forward until slot engages tongue on rear fuel tank bracket.
3. Align hole in seat mounting bracket with seat retention nut in rear fender. Install screw and tighten to 48-72 **in-lbs** (5.4-8.1 Nm).

NOTE

If seat retention nut is damaged or lost, see 2.28 SEAT, Seat Retention Nut Replacement for instructions.

4. Draw free end of passenger seat strap to left side of motorcycle.
5. See Figure 2-109. Start screw to fasten passenger seat strap to seat strap bracket. Feed end of strap into slot of seat strap bracket and tighten screw to 48-72 **in-lbs** (5.4-8.1 Nm).
6. Close left side saddlebag.

WARNING

After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

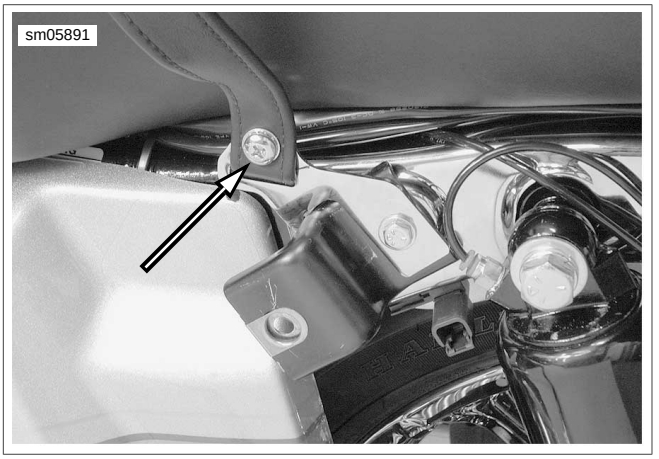
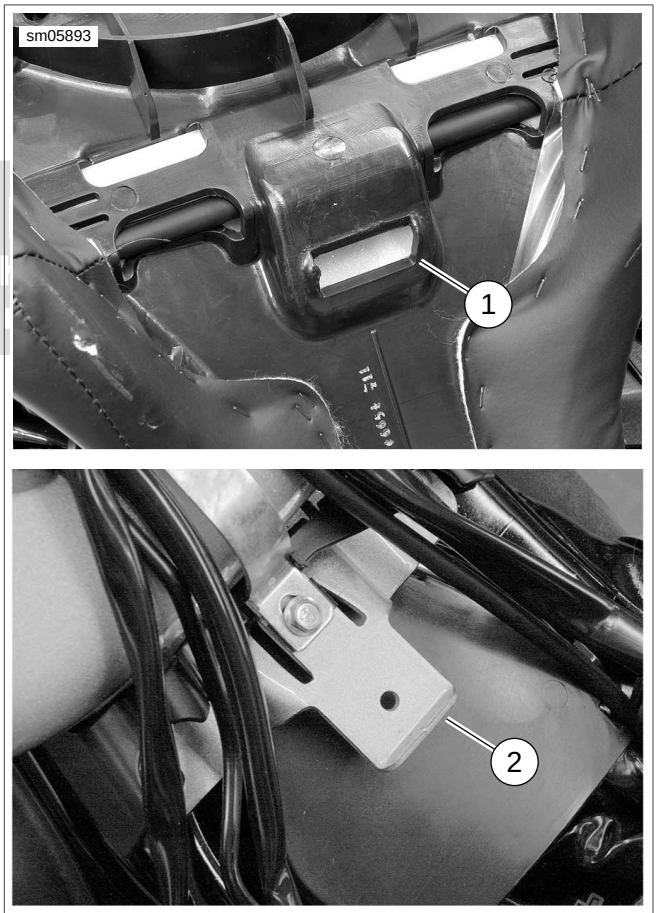


Figure 2-109. Seat Strap Bracket Screw (FLHT/C/U)



1. **Seat bottom slot**
2. **Fuel tank rear bracket tongue**

Figure 2-110. Seat Mounting

SEAT: FLHTC/U

Removal

1. Open left side saddlebag.
2. See Figure 2-109. Remove screw to release passenger seat strap from seat strap bracket. A firm tug may be necessary to free end of strap from slot of seat strap bracket.
3. Draw free end of passenger seat strap to right side of motorcycle.
4. Open Tour-Pak to move passenger seat backrest out of the way.

NOTE

The seat mounting screw can not be accesses with the Tour-Pak mounted in the forward position. If installed in the forward position, remove Tour-Pak and temporarily install in the rearward position. Install in the original position after installing seat. See 2.31 TOUR-PAK for more information.

5. Remove screw to detach seat mounting bracket from top of rear fender. To protect finish of Tour-Pak, cover rear seat mounting bracket with palm of hand.
6. See Figure 2-110. While pushing seat forward, raise rear of seat until bracket clears Tour-Pak. Push seat rearward to free slot from tongue on rear fuel tank bracket.
7. Remove seat from frame.

Installation

1. See Figure 2-110. Place seat on frame.
2. To protect finish of Tour-Pak, cover rear seat mounting bracket with palm of hand.
3. While raising rear of seat approximately 3 in. (76.2 mm), use other hand to firmly push front of seat downward and then forward until slot engages tongue on rear fuel tank bracket.
4. Align hole in seat mounting bracket with seat retention nut in rear fender. Install screw and tighten to 48-72 **in-lbs** (5.4-8.1 Nm).

NOTE

If seat retention nut is damaged or lost, see 2.28 SEAT, Seat Retention Nut Replacement for instructions.

5. Draw free end of passenger seat strap to left side of motorcycle.
6. See Figure 2-109. Start screw to fasten passenger seat strap to seat strap bracket. Feed end of strap into slot of seat strap bracket and tighten screw to 48-72 **in-lbs** (5.4-8.1 Nm).
7. Close left side saddlebag.

WARNING

After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

SEAT: FLHR/C

Removal

1. Remove left side saddlebag.
2. Remove screw (with flat washer) to remove passenger seat strap and saddlebag front mounting bracket from chrome frame tube cover.
3. See Figure 2-111. Draw free end of passenger seat strap to right side of motorcycle (passing through slots in seat on FLHRC models).
4. Remove screw to detach seat mounting bracket from top of rear fender.
5. See Figure 2-110. Push seat rearward to free slot from tongue on rear fuel tank bracket.
6. Remove seat from frame.

Installation

1. Place seat on frame.
2. See Figure 2-110. Firmly push front of seat downward and then forward until slot engages tongue on rear fuel tank bracket.
3. Align hole in seat mounting bracket with seat retention nut in rear fender. Install screw and tighten to 48-72 **in-lbs** (5.4-8.1 Nm).

NOTE

If seat retention nut is damaged or lost, see 2.28 SEAT, Seat Retention Nut Replacement for instructions.

4. See Figure 2-111. Draw free end of passenger seat strap to left side of motorcycle (passing through slots in seat on FLHRC models).

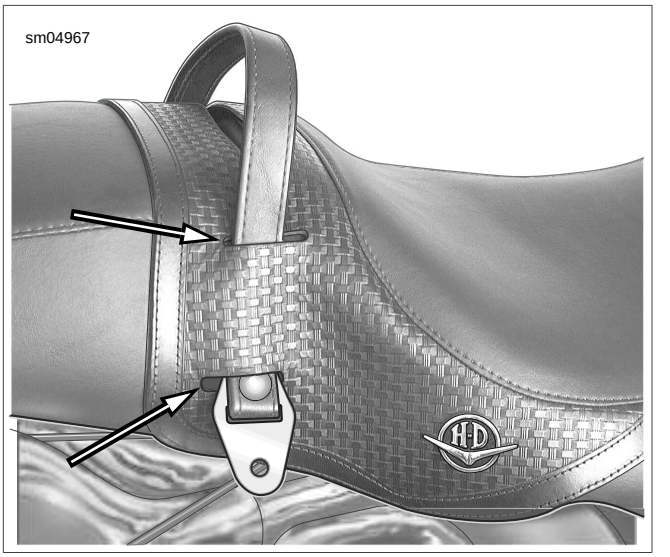


Figure 2-111. Route Passenger Seat Strap Through Slots (FLHRC)

5. Insert screw with flat washer through passenger seat strap and slotted hole of saddlebag front mounting bracket. Insert screw into forward hole in chrome frame tube cover. Snug screw, but do not tighten.

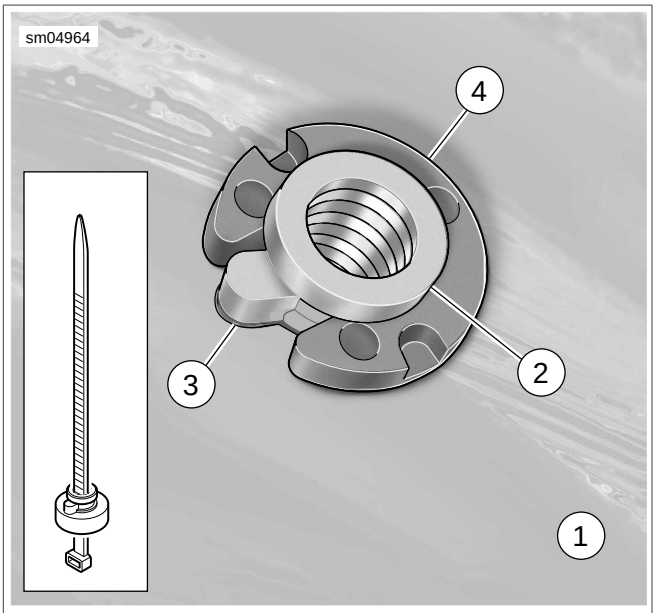
6. Install left side saddlebag.
7. Tighten saddlebag front mounting bracket screw to 60-96 **in-lbs** (6.8-10.8 Nm).

WARNING

After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

SEAT RETENTION NUT REPLACEMENT

1. See inset of Figure 2-112. Slide retention nut over tapered end of cable strap, so that larger OD of nut rests on cable strap eyelet. From bottom of rear fender, feed cable strap up through fender hole.
2. With tab on retention nut seated in notch of fender hole, pull up on cable strap to hold nut snug against underside of rear fender. From the side opposite the tab, slide on the retention washer to lock the position of the retention nut. Remove cable strap.



1. **Rear fender**
2. **Retention nut**
3. **Tab**
4. **Retention washer**

Figure 2-112. Install Seat Retention Nut

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SADDLEBAGS 2.29

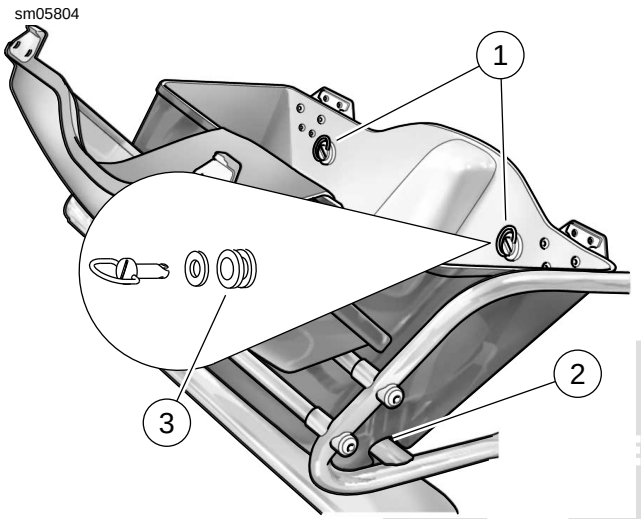
REMOVAL

1. Open saddlebag.
2. See Figure 2-113. Rotate each stud (1) 1/4 turn counterclockwise. Remove bail head studs with flat washers from grommets.

NOTE

On some HDI motorcycles, the bail wire has been removed from the quick release stud. In these cases, turn the stud with a large screwdriver.

3. Remove saddlebag.



1. Stud
2. Lower support rail
3. Grommet

Figure 2-113. Saddlebag Quick-Release Fasteners

INSTALLATION

1. Position saddlebag on motorcycle aligning holes in grommets with those in front and rear mounting brackets.

NOTE

*Replace grommets if torn or deteriorated. Moisten **new** grommet with glass cleaner or soapy water and work smaller OD through hole into saddlebag.*

2. Place flat washers on bail head studs, if removed.
3. With groove at end of stud held in a horizontal position, insert stud through holes in grommet and mounting bracket. When groove engages wire form spring, turn stud clockwise 1/4 turn until it locks in place.

NOTES

- *On some HDI motorcycles, the bail wire has been removed from the quick release stud. In these cases, turn the stud with a large screwdriver.*
- *See Figure 2-113. Molded rubber insert at bottom of saddlebag must fit snugly on lower saddlebag support rail (2). If saddlebag is not fully seated, loosen bolt securing mounting bracket to frame to adjust saddlebag fit. Tighten bolts to 12-15 ft-lbs (16.3-20.3 Nm) after seating saddlebag.*

4. Close saddlebag.

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SADDLEBAG SERVICE 2.30

SADDLEBAG HARDWARE

Removal

1. Lay clean pad or blanket on work bench to protect painted surfaces of saddlebag.
2. Remove saddlebag from motorcycle leaving lid open. See 2.29 SADDLEBAGS.
3. Lay saddlebag flat on pad with the inboard side facing up and the lid closest to you.
4. Remove two T20 TORX screws to release check strap from lid.
5. Remove two T15 TORX screws to release check strap from saddlebag.
6. Remove two remaining T15 TORX screws to remove latch from saddlebag.

NOTE

This procedure assumes that the latch is NOT removed from the saddlebag lid. If there is doubt as to whether the procedure can be accomplished without scratching painted surfaces of the lid, then remove the five remaining T15 TORX screws to completely remove latch.

7. Position lid right side up with latch closest to you.
8. See upper frame of Figure 2-114. Raise latch slightly and rotate hinge on inboard side so that it is topside with the two plastic rub bars pointed upward.
9. See lower frame of Figure 2-114. Rotate rub bar section of hinge to expose hinge pin and spring. Using a flat tip screwdriver, carefully bend crimped end link outward.

NOTE

The end link on opposite side of hinge has a weld spot that prevents pin removal.

10. Reposition lid so that it is upside down with the latch farthest from you. Rotate hinge so that plastic rub bars are positioned beneath latch and spring is topside.
11. See upper frame of Figure 2-115. Using a needle nose pliers, grasp pin through opening just outboard of the spring and push toward the crimped link side. Work pin in this manner until end can be seen exiting crimped link. If necessary, pry crimped link outward a little more to achieve the desired result.
12. See lower frame of Figure 2-115. Grasping end with needle nose pliers, slowly pull pin from links until spring can be slid off opposite end. Only pull pin as far as necessary to remove spring.

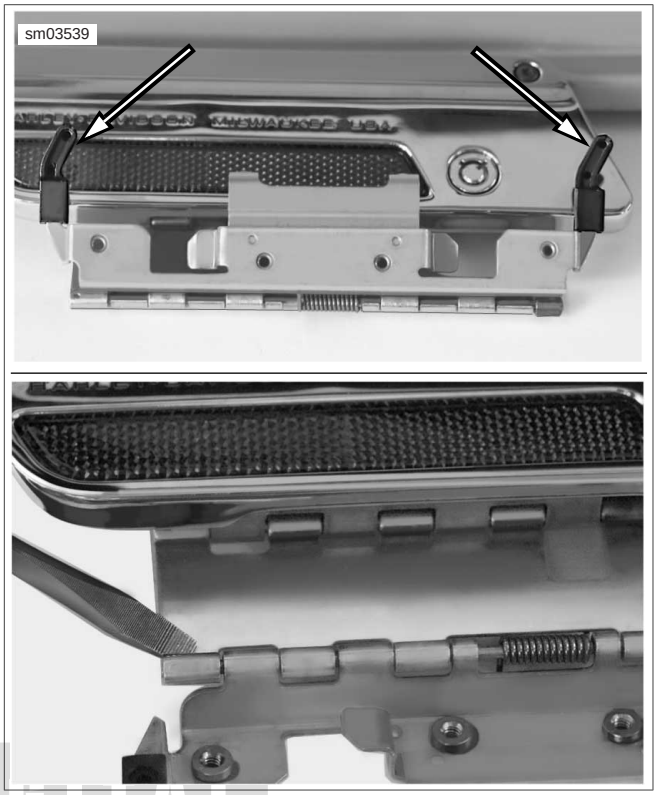


Figure 2-114. Lid Right Side Up With Latch on Near Side

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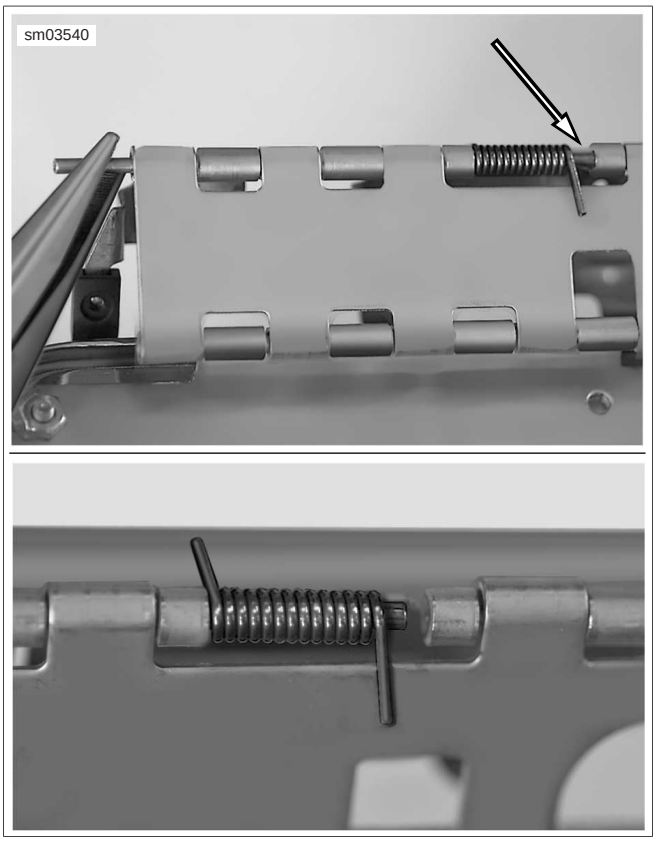


Figure 2-115. Lid Up Side Down With Latch on Far Side

Installation

1. See lower frame of Figure 2-115. Slide **new** spring onto end of pin and orient spring.
2. Slide pin back through links. Using tapered end of needle nose pliers, push end of pin into crimped link.
3. See Figure 2-114. Reposition lid so that it is right side up with latch closest to you. As before, raise latch slightly and rotate hinge on inboard side so that it is topside with plastic rub bars pointing upward. Now rotate rub bar section of hinge to expose hinge pin and spring.
4. Holding lid down with elbow, if necessary, use a pliers to bend crimped link back into its original position, so that pin is captured and will not back out of hinge.
5. Reposition lid so that it is upside down with the latch farthest from you. Move saddlebag forward for reinstallation of lid. Align four holes in saddlebag with those in latch.
6. Install two inboard T15 TORX screws to fasten latch to saddlebag. Alternately tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).
7. Align holes in check strap with those in lid and saddlebag. Orient check strap so that logo is topside with the bottom of the bar and shield on the lid side.
8. Install two T15 TORX screws to fasten check strap and latch to saddlebag. Alternately tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).
9. Install two T20 TORX screws to fasten check strap to lid. Alternately tighten screws to 18-20 **in-lbs** (2.0-2.3 Nm).
10. Close saddlebag and install on motorcycle. See 2.29 SADDLEBAGS.

SADDLEBAG GUARD/SUPPORT RAIL

Removal

1. Remove saddlebag. See 2.29 SADDLEBAGS.
2. Remove fasteners (8) that secure muffler mount to muffler.
3. See Figure 2-116. Disassemble saddlebag guard, support and/or rails as necessary.

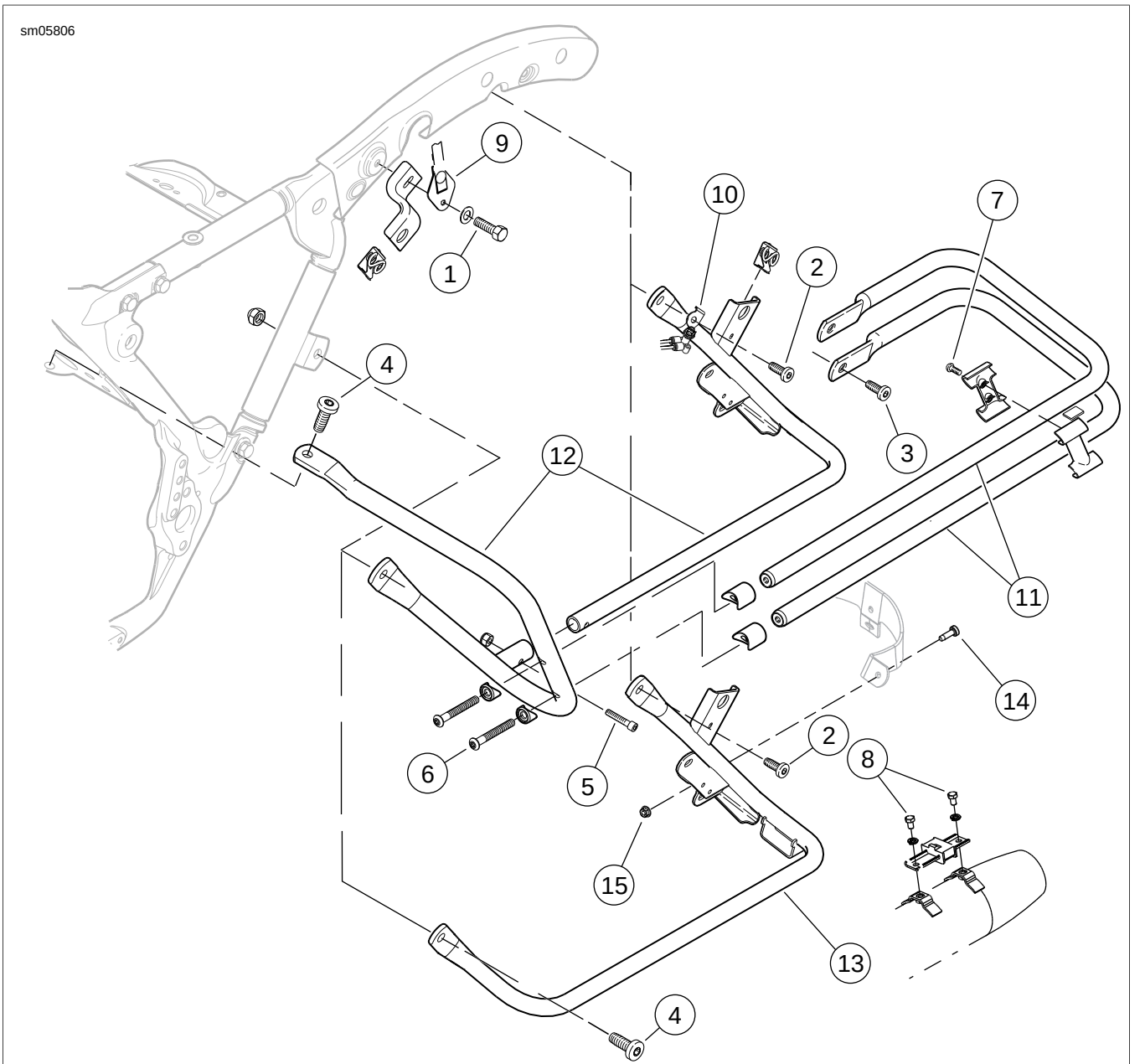
Installation

1. See Figure 2-116. Assemble saddlebag guard, support and/or rails as necessary. Install grab strap (9) along with forward mounting bracket. Air suspension fitting (10) is also secured on left side by fastener (2). Refer to Table 2-19 for the correct fastener torque specifications.
2. Secure muffler to lower rail (12 or 13). Install screws (8) and tighten to 96-144 **in-lbs** (10.8-16.3 Nm).
3. Install saddlebag. See 2.29 SADDLEBAGS.

Table 2-19. Saddlebag Support/Guard Fastener Torque Specifications

ITEM	TORQUE
1	12-15 ft-lbs (16.3-20.3 Nm)
2	15-20 ft-lbs (20.0-27.0 Nm)
3	15-20 ft-lbs (20.0-27.0 Nm)
4	32-36 ft-lbs (43.4-48.8 Nm)
5	70-100 **in-lbs** (8.0-11.0 Nm)
6	72-120 **in-lbs** (8.0-14.0 Nm)
7	30-50 **in-lbs** (3.0-6.0 Nm)
14	15-20 ft-lbs (20.3-27.1 Nm)

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1. Forward mounting bracket fastener
2. Support-to-fender fastener
3. Side rail-to-support fastener
4. Guard-to-frame fastener
5. Support rail-to-guard fastener
6. Side guard-to-front guard fastener
7. Rail clamp fasteners
8. Muffler mount fasteners
9. Grab strap
10. Air suspension fitting
11. Side rails (FLHTC, FLHTCU)
12. Front and lower rails (All except FLTR, FLHX)
13. Support assembly (FLTR, FLHX)
14. Rear fender support-to-saddlebag support fastener
15. Flange locknut

Figure 2-116. Saddlebag Support

REMOVAL/INSTALLATION

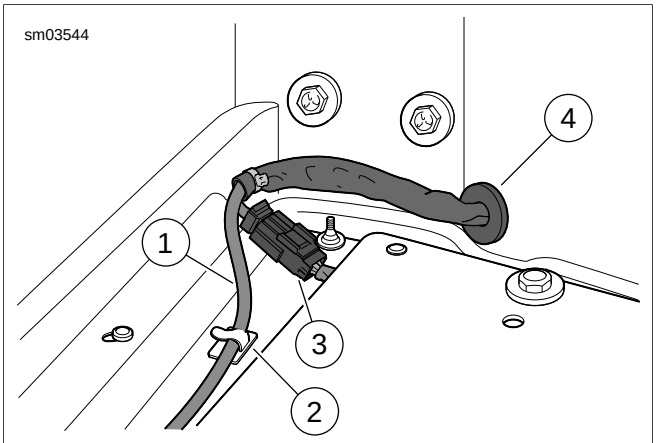
Removal

1. Open Tour-Pak and remove mat (FLHTC) or map pouch and inner liner (FLHTCU).
2. Separate radio antenna cable connector [51]. Release cable from two adhesive clips at bottom of Tour-Pak.
3. See Figure 2-117. Disconnect Tour-Pak lights connector (3).
4. Pull grommet (4) into Tour-Pak and remove from main harness conduit.
5. Feed main harness conduit and connectors through hole in Tour-Pak.
6. Release rear headset receptacle from bracket at bottom of left side speaker box.
7. **FLHTCU:** See Figure 2-118. Disconnect CB antenna cable connector (1). Release cable from two adhesive clips at bottom of Tour-Pak.
8. Pull right side grommet (3) into Tour-Pak and remove from CB antenna cable. Feed CB antenna cable through hole in Tour-Pak.
9. **FLHTCU:** See Figure 2-119. Remove three fasteners (1) and flat washers to release each speaker box (2).

NOTE

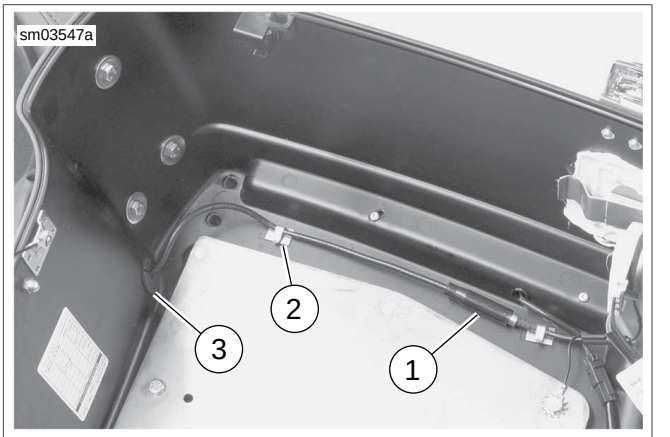
Make note of which set of locating holes are used to mount Tour-Pak.

10. Remove four bolts and lock washers (4) from inside Tour-Pak. Be sure to have a firm grasp on the Tour-Pak as the bolts are removed. Remove Tour-Pak.



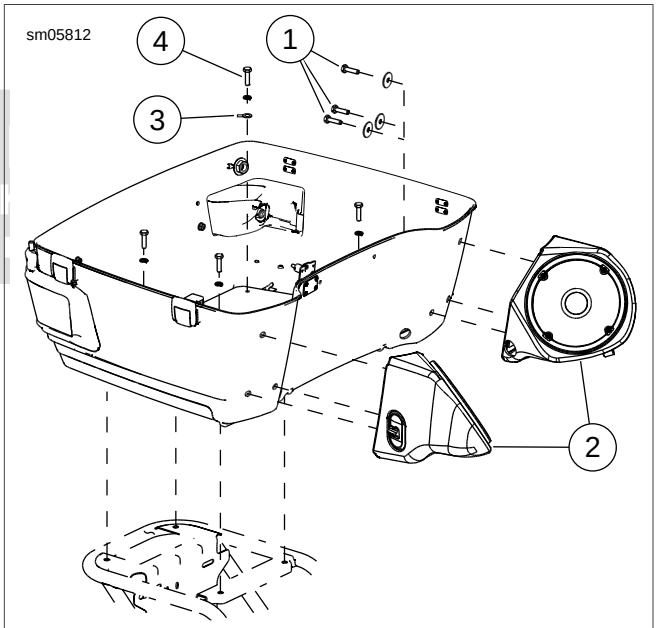
1. **Radio antenna cable**
2. **Adhesive clip**
3. **Tour-pak lights connector [12]**
4. **Grommet**

Figure 2-117. Disconnect Tour-Pak Lights Connector



1. **CB antenna cable connector [50]**
2. **Adhesive clip**
3. **Grommet**

Figure 2-118. Disconnect CB Antenna Cable Connector



1. **Speaker box fasteners**
2. **Speakers**
3. **Ground ring terminal**
4. **Bolts and lock washers (4)**

Figure 2-119. Tour-Pak Mounting Bolts

Installation

1. Place Tour-Pak on luggage rack and open lid.
2. See Figure 2-119. Install four bolts (4) from inside Tour-Pak. Install radio antenna ground ring terminal (3) under lock washer of left-rear bolt.
3. In a crosswise pattern, tighten bolts to 96-120 **in-lbs** (10.8-13.6 Nm).

4. Install speaker boxes and secure with fasteners and flat washers (1). Tighten fasteners to 25-35 **in-lbs** (2.8-4.0 Nm).
5. **FLHTCU:** See Figure 2-118. Pass CB antenna cable through hole in Tour-Pak. Capture cable in grommet. Install grommet in hole with the larger OD facing inside.
6. Connect CB antenna cable connector (1). Capture cable in two adhesive clips (2) at bottom of Tour-Pak.
7. Capture rear headset receptacle in bracket at bottom of left side speaker box.
8. See Figure 2-117. Feed connectors and main harness conduit through hole in Tour-pak. Capture conduit in grommet. Install grommet in hole with the larger OD facing inside.
9. Connect Tour-pak lights connector (3).
10. Mate radio antenna cable connector to antenna. Capture cable in two adhesive clips at bottom of Tour-Pak.
11. Install molded liner and map pouch (FLHTCU) or rubber mat (FLHTC) in Tour-Pak.

ADJUSTMENT

NOTE

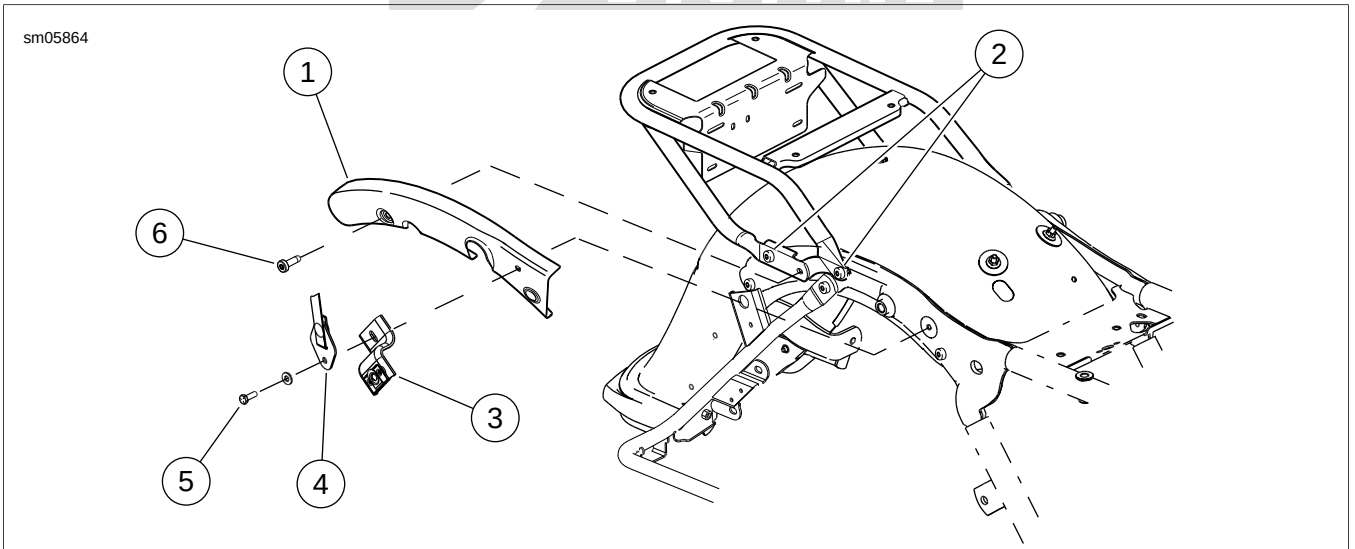
The Tour-Pak can be moved forward/rearward approximately 1 in. (25.4 mm) for best passenger comfort.

1. Open Tour-Pak and remove mat (FLHTC) or map pouch and inner liner (FLHTCU).
2. See Figure 2-119. Remove four bolts and lock washers (4) from inside Tour-Pak. Be sure to have a firm grasp on the Tour-Pak as the bolts are removed.
3. Move Tour-Pak to the desired position.
4. See Figure 2-119. Install four bolts (4) from inside Tour-Pak. Install radio antenna ground ring terminal (3) under lock washer of left-rear bolt.
5. In a crosswise pattern, tighten bolts to 96-120 **in-lbs** (10.8-13.6 Nm).
6. Verify that wire harness to Tour-pak is not bunched or stretched at any point. Rearrange wire harness if necessary and install **new** cable straps.
7. Install molded liner and map pouch (FLHTCU) or rubber mat (FLHTC) in Tour-Pak.

LUGGAGE RACK/TOUR-PAK SUPPORT

Removal

1. Remove cable straps as required to free harnesses from luggage rack. Take note of cable strap locations for reassembly.
2. See Figure 2-120. Remove fastener (5), seat strap (4), and forward saddlebag bracket (3).
3. Remove fastener (6) and remove cover (1).
4. Remove two fasteners (2) from each side and remove luggage rack.



1. **Cover (2)**
2. **Fastener, luggage rack to fender support (4)**
3. **Forward saddlebag bracket (2)**
4. **Seat strap**
5. **Cover fastener, front (2)**
6. **Cover fastener, rear (2)**

Figure 2-120. Luggage Rack

Assembly and Installation

1. See Figure 2-120. Install luggage rack and start fasteners (2 and 6).
2. Tighten fasteners (2) to 15-20 ft lbs (20.3-27.1 Nm).
3. Remove fastener (6) and install cover (1). Secure cover, front saddlebag bracket (3), and seat strap (4) with fastener (5) and flat washer. Do not tighten at this time.
4. Install fastener (6) and tighten to 15-20 ft lbs (20.3-27.1 Nm).

5. Secure harnesses as necessary to the luggage rack.
6. Secure saddlebags, rotating brackets (3) as necessary to align with forward saddlebag fastener. Verify saddlebag is securely engaged with lower support and tighten fastener (5) to 12-15 ft lbs (16.3-20.3 Nm).

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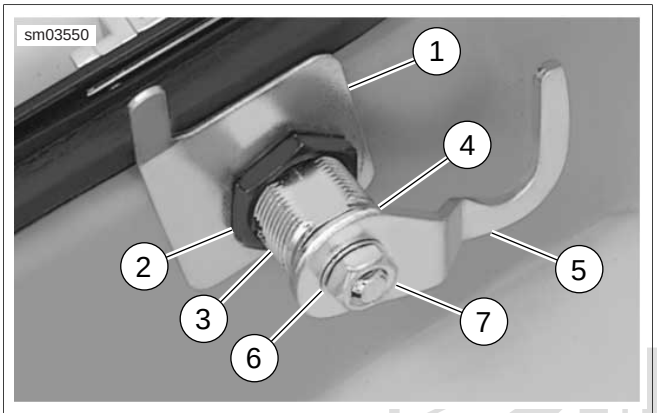
LOCKSET

Removal

NOTE

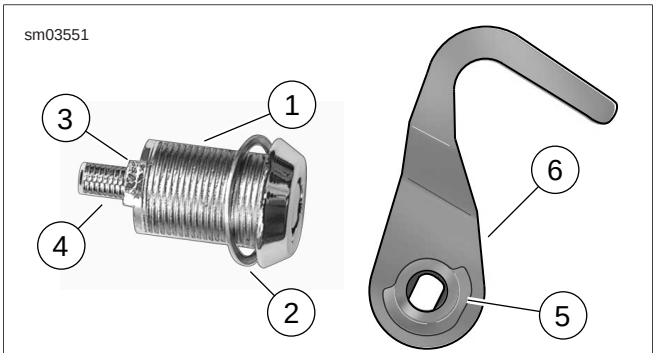
For replacement of the lockset catch, see 2.32 TOUR-PAK SERVICE, Latches/Lockset Catch.

1. See Figure 2-121. Remove hex nut (7), internal tooth lockwasher (6), cam hook (5) and cam washer (4). Remove jam nut and lock guide.
2. See Figure 2-122. Remove lockset (3). Remove thin washer (2) from threaded body of lockset.



1. **Lock guide**
2. **Jam nut**
3. **Lockset**
4. **Cam washer**
5. **Cam hook**
6. **Lockwasher**
7. **Hex nut**

Figure 2-121. Lockset Assembly



1. **Lockset**
2. **Thin washer**
3. **Cam stop**
4. **Threaded stud**
5. **Cam washer**
6. **Cam hook**

Figure 2-122. Lockset Mechanism

Installation

1. See Figure 2-122. Slide thin washer (2) down threaded body of lockset.
2. With cam stop (3) facing toward front of Tour-Pak lid, install lockset into hole.
3. See Figure 2-121. Install lock guide (1) as shown.
4. Install jam nut and tighten to 30-45 **in-lbs** (3.4-5.1 Nm).
5. Verify that groove in threaded stud of lockset is facing rear of Tour-Pak lid. Use key to rotate threaded stud, if necessary.
6. See Figure 2-122. Align cam hook (6) and cam washer (5) as shown. With the cam hook toward the front of Tour-Pak lid and cam washer on the inboard side, slide assembly down threaded stud.
7. Install internal tooth lockwasher and hex nut onto threaded stud. Tighten hex nut to 25-35 **in-lbs** (2.8-4.0 Nm).

HINGES

PART NUMBER	TOOL NAME
HD-39787A	RIVET TOOL

Removal

1. Remove tether. See 2.32 TOUR-PAK SERVICE, Tether.
2. Holding hinge pin with a T25 TORX bit (inboard side), remove T15 TORX screw (outboard side).
3. Remove hinge pin from hinge.
4. Repeat previous steps to remove second hinge pin. Remove Tour-Pak lid.
5. Using a 3/16 inch drill bit, drill out eight rivets from inside Tour-Pak.
6. Remove hinge and backplates.

Installation

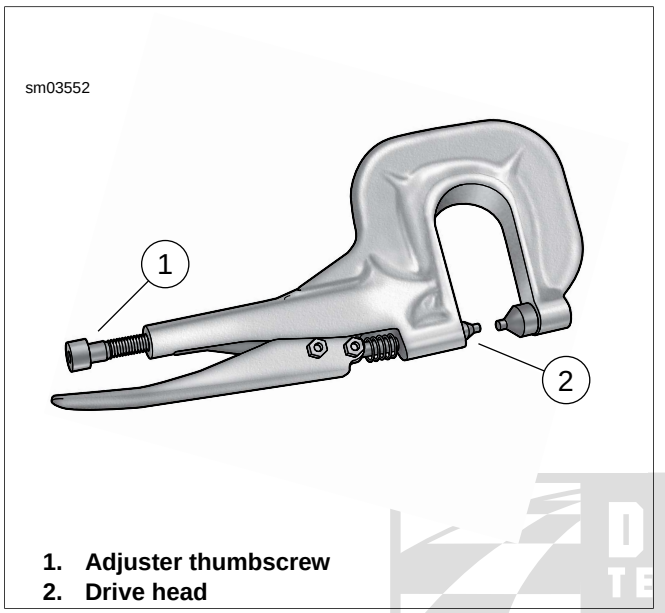
1. With the head of the **new** rivet on the outboard side of the Tour-Pak, slide rivet through holes in hinge, Tour-Pak and backplate.
2. See Figure 2-123. Obtain RIVET TOOL (Part No. HD-39787A).
3. Orient tool so that head of rivet is seated in depression of drive head. Turn adjuster thumbscrew in or out of handle until both ends of rivet are captured.
4. Slowly squeeze handle of tool to compress rivet. Turn adjuster thumbscrew slightly in a clockwise direction and then squeeze handle again to further compress rivet. Repeat step as necessary until rivet is fully installed.

NOTE

Compress rivet in small increments only. This method provides for best retention and alignment of parts and avoids possible damage to tool and painted surfaces of Tour-Pak.

5. Repeat previous steps to install remaining rivets.

6. Install lid onto Tour-Pak engaging upper and lower hinges.
7. Install hinge pin with the T25 TORX bit recess on the inboard side of the hinge.
8. Apply a small dab of Loctite High Strength Threadlocker 262 (red) to threads of T15 TORX screw.
9. Install T15 TORX screw into hinge pin and tighten to 20-25 **in-lbs** (2.3-2.8 Nm).
10. Repeat previous steps to install second hinge pin.
11. Install tether. See 2.32 TOUR-PAK SERVICE, Tether.



1. **Adjuster thumbscrew**
2. **Drive head**

Figure 2-123. Rivet Tool (HD-39787A)

Properly oriented, flat side of lockset catch should be topside.

6. With open side of spacer facing Tour-Pak and rib at bottom, slide spacer over ends of screws.
7. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of screws and start into threaded bosses on latch. Properly oriented, portion of latch not mated with spacer should be at the top.
8. Tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).



1. **Lockset catch**
2. **T15 TORX screw**
3. **Front latch**

Figure 2-124. Front Latch Assembly

LATCHES/LOCKSET CATCH

Removal

1. Remove two T15 TORX screws (with flat washers) to release rear latch and spacer from right side of Tour-Pak.
2. See Figure 2-124. Remove two T15 TORX screws to release front latch, spacer and lockset catch from Tour-Pak.

Installation

1. From inside Tour-Pak, slide two short T15 TORX screws (with flat washers) through rear holes on right side of Tour-Pak.
2. With open side of spacer facing Tour-Pak and rib at bottom, slide spacer over ends of screws.
3. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of screws and start into threaded bosses on latch. Properly oriented, portion of latch not mated with spacer should be at the top.
4. Tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).
5. See Figure 2-124. Slide two long T15 TORX screws through holes in lockset catch. From inside Tour-Pak, slide screws through front holes on right side of Tour-Pak.

CATCHES

Removal

1. Using a 3/16 inch drill bit, drill out two rivets from inside Tour-Pak lid.
2. Remove catch and backplate.

Installation

1. With the head of the **new** rivet on the outboard side of the Tour-Pak, slide rivet through holes in catch, Tour-Pak lid and backplate.
2. Install rivets. See 2.32 TOUR-PAK SERVICE, Hinges.

TETHER

Removal

NOTE

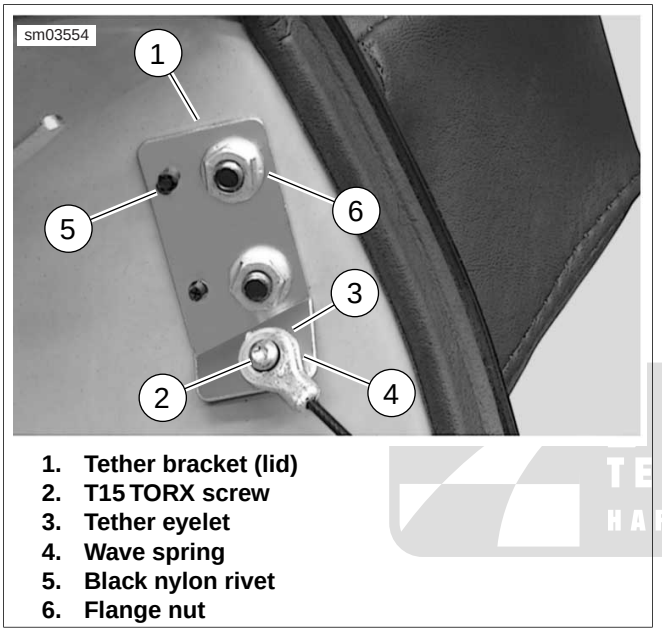
Exercise caution to keep lid from opening beyond the normal 90 degree of travel or damage to painted surfaces can occur.

1. See Figure 2-125. Remove T15 TORX screw from threaded boss on tether bracket.
2. Remove tether eyelet and wave spring from threaded boss.

3. Repeat previous steps to remove opposite end of tether from second tether bracket.

Installation

1. With the concave side toward the tether bracket, install wave spring onto threaded boss.
2. Install tether eyelet onto threaded boss.
3. Apply a small dab of Loctite High Strength Threadlocker 262 (red) to threads of T15 TORX screw.
4. See Figure 2-125. Install screw into threaded boss and tighten to 20-25 **in-lbs** (2.3-2.8 Nm).
5. Repeat previous steps to fasten opposite end of tether to second tether bracket.



1. **Tether bracket (lid)**
2. **T15 TORX screw**
3. **Tether eyelet**
4. **Wave spring**
5. **Black nylon rivet**
6. **Flange nut**

Figure 2-125. Tour-Pak Tether Bracket Assembly

TETHER BRACKETS

Removing Tether Bracket from Tour-Pak

1. Remove tether. See 2.32 TOUR-PAK SERVICE, Tether.
2. Using a 3/16 inch drill bit, drill out four rivets from inside Tour-Pak.
3. Remove tether bracket and backplate.

Removing Tether Bracket from Tour-Pak Lid

1. Remove tether. See 2.32 TOUR-PAK SERVICE, Tether.
2. See Figure 2-125. From inside Tour-Pak lid, center a 3/32 inch punch on pin at center of black nylon rivet. Using a small hammer, gently tap pin out of rivet. At outside of Tour-Pak, pull rivet from holes in tether bracket, Tour-Pak lid and passenger backrest bracket. Repeat step to remove second nylon rivet.
3. Remove two flange nuts from studs of passenger backrest bracket and remove tether bracket.

Installing Tether Bracket on Tour-Pak Lid

1. See Figure 2-125. From inside Tour-Pak lid, install tether bracket on studs of passenger backrest bracket and start flange nuts.
2. At outside of Tour-Pak, insert black nylon rivet through holes in passenger backrest bracket, Tour-Pak lid and tether bracket. Insert pin into head of rivet until flush. Install second rivet in the same manner.
3. Alternately tighten flange nuts to 40-60 **in-lbs** (4.5-6.8 Nm).
4. Install tether. See 2.32 TOUR-PAK SERVICE, Tether.

Installing Tether Bracket on Tour-Pak

1. With the head of the **new** rivet on the outboard side of the Tour-Pak, slide rivet through holes in backplate, Tour-Pak and tether bracket (with the threaded boss topside).
2. Install rivets. See 2.32 TOUR-PAK SERVICE, Hinges.
3. Install tether. See 2.32 TOUR-PAK SERVICE, Tether.

DIGITAL TECHNICIAN II HARLEY

TOUR-PAK LIGHTS 2.33

GENERAL

All domestic model Ultra Tour-Paks are equipped with side marker lights. Ultra models also have rear wrap-around lights, each of which contains a 2-filament lamp. One filament is a supplemental brake light and the other a supplemental tail lamp.

SIDE MARKER LIGHTS (FLHTCU)

Removal

1. Remove map pouch and molded liner from Tour-Pak.
2. See Figure 2-127. Disconnect side marker lights connector (4 or 5).
3. Remove two T15 TORX screws and remove side marker lights.

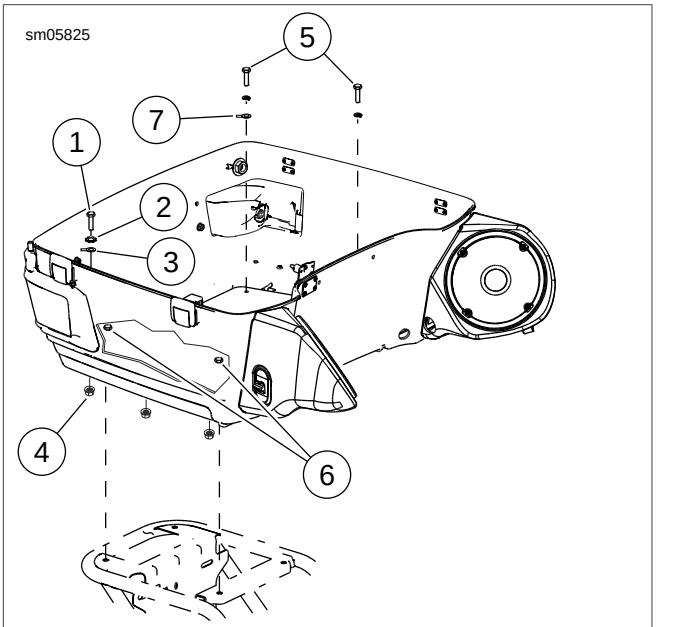
Installation

1. See Figure 2-127. Feed socket through hole in Tour-Pak and place side marker lights into position.
2. Install two T15 TORX screws and tighten to 20-25 **in-lbs** (2.3-2.8 Nm).
3. Connect side marker lights connector (4 or 5).
4. Install molded liner and map pouch. Close Tour-Pak.

TOUR-PAK LIGHTS HARNESS

Removal

1. See Figure 2-126. Remove right-rear fastener (1), external tooth lockwasher (2) and flange nut (4) to release harness ground ring terminal (3).
2. See Figure 2-127. Remove tail lamp bulb socket from both wrap-around lights.
3. Disconnect two side marker lights connectors. Release harness from adhesive clips.
4. See Figure 2-126. Remove five remaining flange nuts (4) from bottom of Tour-Pak.
5. Remove two left side attaching screws (5) and lock washers.
6. Loosen two right side attaching screws (6) several turns but do not remove.
7. Lift left side of metal plate enough to remove harness from underneath it.
8. Remove Tour-Pak lights harness.



1. **Right-rear fastener**
2. **External tooth washer**
3. **Ground ring terminal**
4. **Flange nut (6)**
5. **Left side attaching screws**
6. **Right side attaching screws**
7. **Ground ring terminal**

Figure 2-126. Tour-Pak

Installation

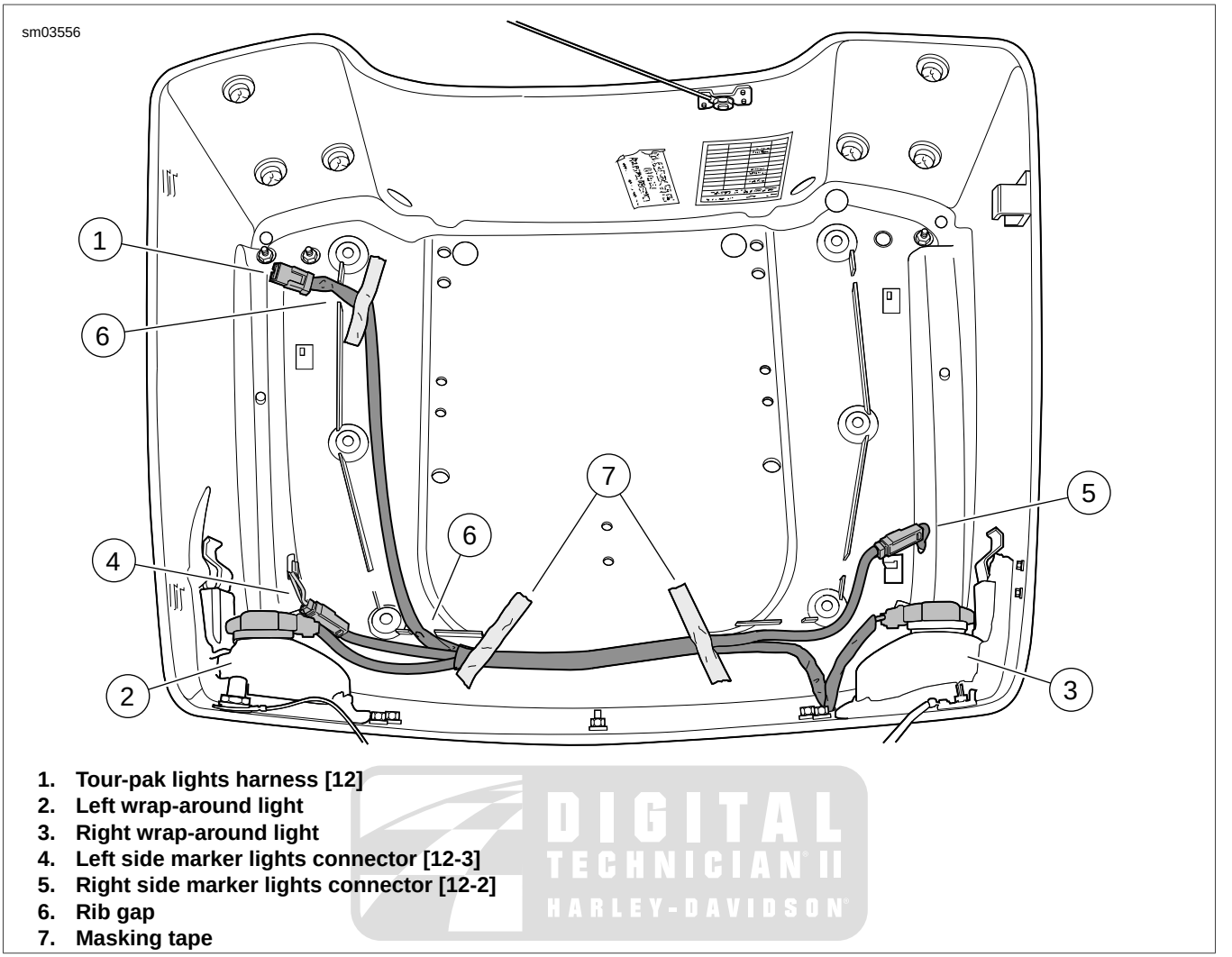
1. Place Tour-Pak lights harness at bottom of Tour-Pak as shown in Figure 2-127.

NOTE

Tour-Pak lights harness is the only one routed under the metal plate.

2. Lift metal plate and route lights harness inboard of bosses as shown, with connector (1) outboard of the metal plate. Use masking tape as necessary to fix position.
3. See Figure 2-126. Install two left side fasteners (5) with lock washers. Verify radio antenna ground ring terminal (7) is installed under left rear fastener.
4. Tighten fasteners (5, 6) to 96-120 **in-lbs** (10.8-13.6 Nm).
5. Install hex head screw (1), external tooth lockwasher (2) and harness ground ring terminal (3). Install flange nut (4).
6. Install five remaining flange nuts (4) on threaded studs of metal plate. Tighten all flange nuts to 65-70 **in-lbs** (7.3-7.9 Nm).
7. Connect two side marker lights connectors. Capture harness in two adhesive clips at rear of Tour-Pak.
8. Install tail lamp bulb socket in both wrap-around lights.

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1. **Tour-pak lights harness [12]**
2. **Left wrap-around light**
3. **Right wrap-around light**
4. **Left side marker lights connector [12-3]**
5. **Right side marker lights connector [12-2]**
6. **Rib gap**
7. **Masking tape**

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Figure 2-127. Tour-Pak Lights Harness (FLHTCU)

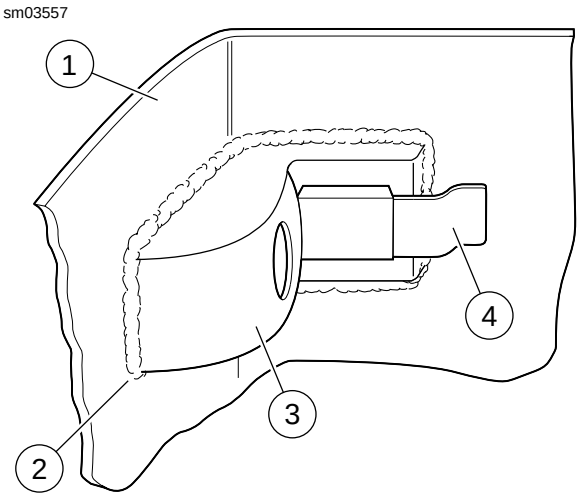
WRAP-AROUND LIGHTS (FLHTCU)

Bulb Replacement

1. Remove map pouch and molded liner from Tour-Pak.
2. Remove bulb socket from wrap-around light and replace bulb.
3. Install bulb socket in wrap-around light.
4. Install molded liner and map pouch in Tour-Pak.

Removal

1. Remove map pouch and molded liner from Tour-Pak.
2. Remove both antenna masts from lamp housing.
3. Remove bulb sockets from wrap-around light.
4. If equipped, remove nut, tooth washer and ring terminal from CB antenna stud. Remove stud using a 2.5 mm hex key and remove base from housing.
5. Disconnect radio antenna cable connector.
6. Remove nut from radio antenna cable connector at back of Tour-Pak. Remove ring terminal and large flat washer from connector.



1. **Tour-pak**
2. **Caulking**
3. **Bulb housing**
4. **Metal clip**

Figure 2-128. Wrap-around Light Assembly

7. Install nut back onto connector and use a 1/2 in.-20 UNF nut as a jam nut. Remove connector stud from radio antenna base. Remove base from lamp housing.
8. See Figure 2-128. Remove caulking from around light bar. Remove four flange nuts and metal clips to free light bar from Tour-Pak.

Installation

1. See Figure 2-128. Install light bar and secure with metal clips and flange nuts. Seal perimeter of light bar with RTV silicone sealer (Part No. 99710-88).
2. Install radio antenna base into lamp housing and tighten securely. Remove 1/2 in.-20 UNF jam nut and original nut.
3. Install large flat washer and ring terminal onto connector. Install nut and tighten securely.
4. Connect radio antenna cable connector.
5. If equipped, install CB antenna base into lamp housing. Install stud and tighten with 2.5 mm hex key.
6. Install ring terminal, tooth washer and nut onto CB antenna stud. Tighten nut securely.
7. Install bulb socket of both left and right side wrap-around lights.
8. Install both antenna masts.
9. Install molded liner in Tour-Pak. Install map pouch and secure using acorn nuts. Close Tour-Pak.
10. Check SWR and adjust if necessary. Follow the SWR Adjustment procedure in ELECTRICAL DIAGNOSTIC MANUAL.

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TOUR-PAK BACKREST 2.34

PASSENGER BACKREST

Removal

1. Open Tour-Pak.
2. See Figure 2-129. Remove two flange nuts and backplate to release center backrest from Tour-Pak lid.
3. Remove two flange nuts to release left side backrest.

NOTE

Be sure that black nylon rivets are in place before removing flange nuts to release right side backrest or tether bracket will come free. Unexpected release of the tether bracket can allow the Tour-Pak lid to swing fully open, which may result in damage to hinges and painted surfaces. If black nylon rivets are missing, be sure to hold Tour-Pak lid as the second flange nut is removed.



1. **Center flange nuts and backplate**
2. **Left side flange nuts**
3. **Right side flange nuts, tether bracket and black nylon rivets**
4. **Passenger backrest**

Figure 2-129. Tour-Pak Lid (Underside)

4. Remove two flange nuts to release right side backrest.
5. Carefully pull studs on backrest brackets from holes in Tour-Pak lid.

Installation

1. Slide studs on center backrest cushion plate through holes in Tour-Pak lid. With the nylon side facing the Tour-Pak, install backplate on studs and start flange nuts.
2. Slide studs on left side backrest "L" bracket through holes in Tour-Pak lid and start flange nuts.
3. Slide studs on right side backrest "L" bracket through holes in Tour-Pak lid and tether bracket and start flange nuts.
4. Alternately tighten six flange nuts to 40-60 **in-lbs** (4.5-6.8 Nm).
5. Close Tour-Pak.

RUBBER ISOLATORS

Removal

1. Remove passenger backrest. See 2.34 TOUR-PAK BACKREST, Passenger Backrest.
2. **Center isolator:** See Figure 2-130. Remove flange nut with lockwasher to release cushion plate from rubber isolator stud. Remove flange nut with lockwasher to release other stud from backrest support bracket.
3. **Outside isolator:** See Figure 2-131. Remove flange nut with lockwasher to release "L" bracket from rubber isolator stud. Rotate rubber isolator to remove other stud from threaded hole in backrest.

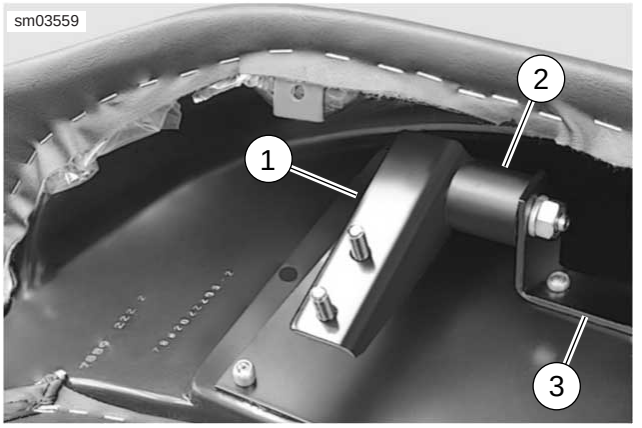
Installation

1. **Center isolator:** See Figure 2-130. Insert stud of **new** rubber isolator into hole of backrest support bracket and install lockwasher and flange nut. Tighten flange nut until snug. Install cushion plate, lockwasher and flange nut on other stud. Orient cushion plate so that it is parallel to backrest and then finger tighten flange nut only.
2. **Outside isolator:** See Figure 2-131. Install stud of **new** rubber isolator into threaded hole in backrest until snug. Install "L" bracket, lockwasher and flange nut on other stud. Finger tighten flange nut only.

NOTE

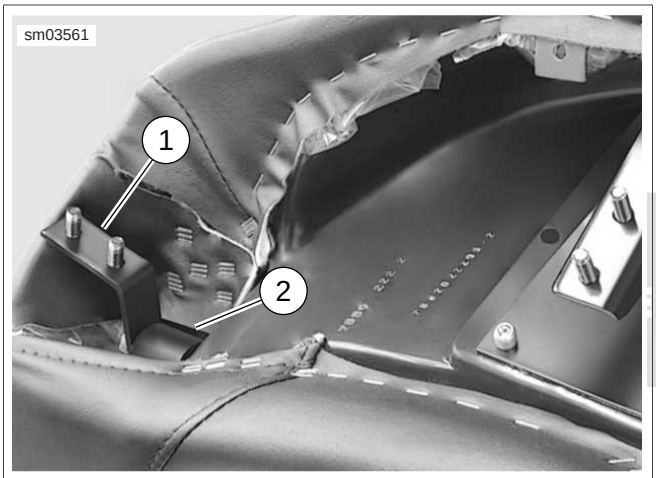
Always hold rubber isolator on end to be installed. Do not grasp middle of rubber isolator or opposite end as excessive twisting can result in separation of molded parts or other damage.

3. Install passenger backrest. See 2.34 TOUR-PAK BACKREST, Passenger Backrest.
4. Gently pull back cover material of backrest to expose underside and final tighten flange nuts previously finger tightened.
5. Verify that each side of rubber isolator is not twisted or under any torsional load. Loosen flange nuts and adjust rubber isolator if necessary.



1. **Cushion plate**
2. **Rubber isolator**
3. **Backrest support bracket**

Figure 2-130. Center Isolator



1. **"L" bracket**
2. **Rubber isolator**

Figure 2-131. Outside Isolator

PASSENGER BACKREST FLAP (FLHTCU)

Removal

1. Remove map pouch and molded liner from Tour-Pak.
2. Holding acorn nuts inside Tour-Pak, remove two T25 TORX screws (with flat washers) at front.
3. Remove backrest flap.

Installation

1. Align holes in backrest flap with those at front of Tour-Pak.
2. Slide two T25 TORX screws (with flat washers) through holes in backrest flap and Tour-Pak. Inside Tour-Pak, install acorn nuts.
3. Holding acorn nuts, tighten screws to 21-24 **in-lbs** (2.4-2.7 Nm).
4. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers). Close Tour-Pak.

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TOUR-PAK SPEAKER BOX: FLHTCU 2.35

SPEAKER BOX (FLHTCU)

Removal

NOTE

Remove lower speaker box retaining bolt to ease removal of connectors from speaker box.

1. Remove grommet and gently pull on wire harness to draw rear speaker/passenger controls connector out of speaker box. Separate connector halves.
2. Remove map pouch and molded liner from Tour-Pak.
3. Remove three bolts with flat washers to free speaker box from Tour-Pak.

Installation

1. Install three bolts with flat washers to secure speaker box to Tour-Pak. Alternately tighten bolts to 25-35 **in-lbs** (2.8-4.0 Nm).
2. Install molded liner and map pouch in Tour-Pak.
3. Connect rear speaker/passenger controls connector. Feed connector back up into speaker box pressing trim ring into hole.

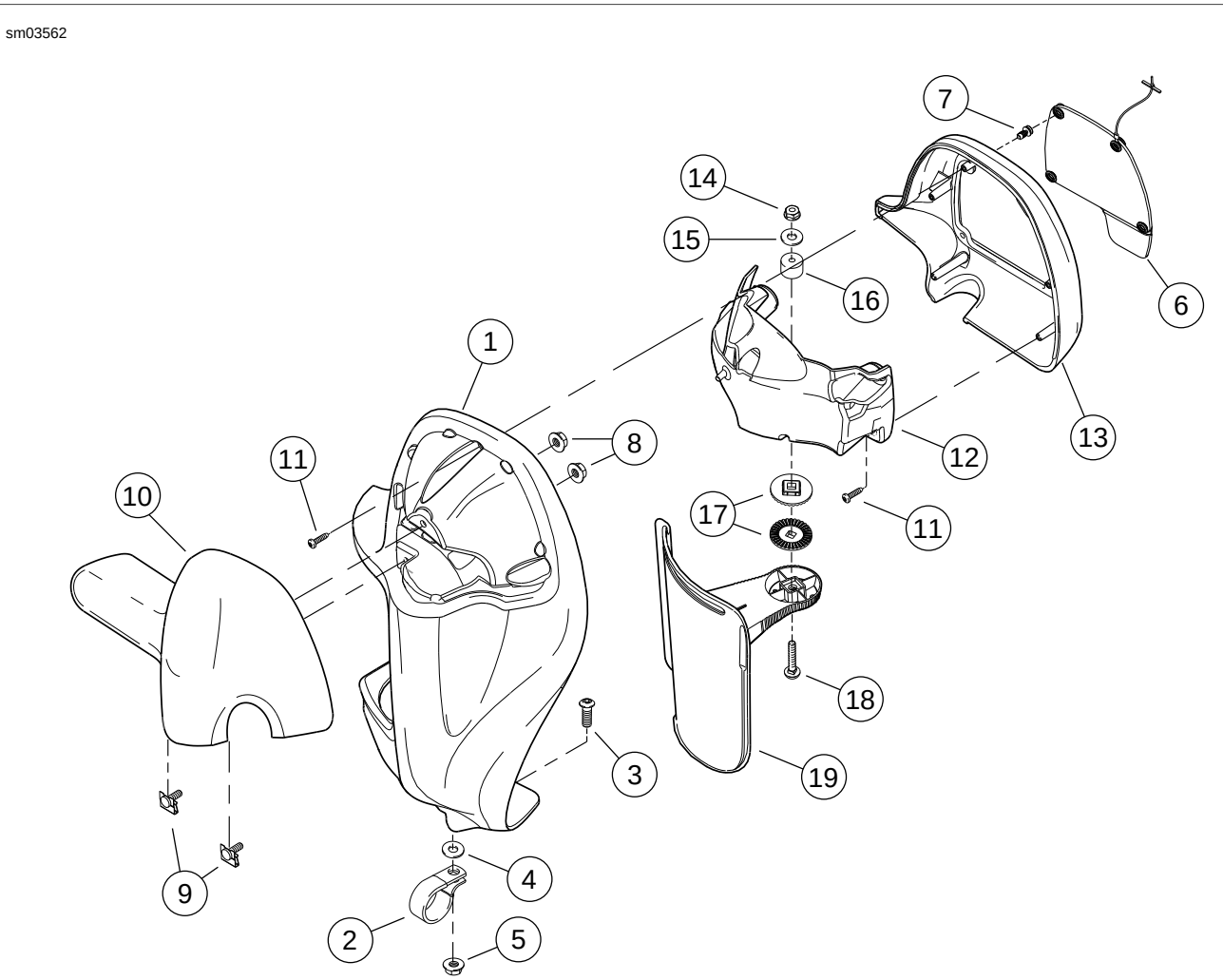
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

LOWER FAIRING AND ENGINE GUARD 2.36

LOWER FAIRING (FLHTCU)

Removal

1. See Figure 2-132. Remove glove box door flap (6).
2. Remove two flange nuts (8) from clip studs and remove fairing cap (10). Do not twist or rotate fairing cap or damage may result.
3. Hold locknut (5) and turn screw (3) to free assembly. Discard rubber washer.
4. Repeat procedure on other side of motorcycle.



1. **Lower fairing**
2. **Engine guard clamp**
3. **T40 TORX screw**
4. **Rubber washer**
5. **Locknut**
6. **Door flap**
7. **Push-in snap (4)**
8. **Flange nut (2)**
9. **Clip stud (2)**
10. **Fairing cap**
11. **T20 TORX screw (5)**
12. **Glove box tray**
13. **Glove box door**
14. **Locknut**
15. **Flat washer**
16. **Compression spring**
17. **Serrated washer (1 black, 1 white)**
18. **Pivot screw**
19. **Vent door**

Figure 2-132. Lower Fairing Assembly

Disassembly

1. See Figure 2-132. Remove three screws (11) to release glove box door (13) and glove box tray (12).
2. Remove two screws (11) to release glove box door from glove box tray.
3. Remove locknut (14), flat washer (15), compression spring (rubber sleeve) (16), glove box tray and two serrated washers (17).
4. Remove pivot screw from vent door arm.

Assembly

1. Slide pivot screw up through hole in vent door arm.
2. With the teeth facing upward, install serrated washer. Square shaped boss at bottom of serrated washer should engage square recess in vent door arm.

NOTE

Use one black and one white serrated washer. Using two washers of the same color may result in a chirping noise when the lower fairings are adjusted.

3. Slide second serrated washer over pivot screw so that teeth engage those on first serrated washer.
4. Engage square shaped boss at top of second serrated washer with square hole on glove box tray.
5. Install compression spring (rubber sleeve), flat washer and locknut on pivot screw. Verify that pin at front of glove box tray engages slot at top of vent door.
6. Tighten locknut only until flat washer is snug (does not rotate) and then tighten an additional 1-1/2 turns. Verify proper vent door operation.

NOTE

For best results, the 0.50 in. (12.7 mm) compression spring must be compressed to a height of 0.420 to 0.460 in. (10.7-11.7 mm).

7. Secure glove box tray to glove box door with two screws (11). Tighten to 20-25 **in-lbs** (2.3-2.8 Nm).
8. Secure glove box tray to lower fairing with three screws. Tighten to 20-25 **in-lbs** (2.3-2.8 Nm).
9. Install glove box door flap.

Installation

1. Place lower fairing into position at front of engine guard.
2. Install **new** rubber washer, clamp and locknut to attach bottom of lower fairing to engine guard. Do not tighten locknut.
3. Verify that two clip studs are fully installed on fairing cap.
4. Position fairing cap at front of engine guard and against lower fairing so that clip studs engage holes in lower fairing and glove box tray. Reaching into glove box, start two flange nuts on clip studs.
5. Verify that lower fairing is square. Tighten flange nuts on clip studs to 35-40 **in-lbs** (4.0-4.5 Nm).
6. Hold locknut at bottom of lower fairing and turn inside T40 TORX screw to fasten assembly to engine guard clamp. Tighten screw to 90-100 **in-lbs** (10.2-11.3 Nm).
7. Repeat procedure on other side of motorcycle.

SERRATED WASHER REPLACEMENT

Removal

1. Remove glove box door flap.
2. Remove locknut, flat washer and compression spring (rubber sleeve) from pivot screw in vent door arm. Remove pivot screw.
3. Carefully extract serrated washers. Discard washers.

Installation

NOTE

Use one black and one white serrated washer. Using two washers of the same color may result in a chirping noise when the lower fairings are adjusted.

1. With the teeth up, install **new** serrated washer at top of vent door arm. Be sure that square shaped boss on washer engages square recess in arm.
2. With the teeth down, install **new** serrated washer at bottom of glove box tray. Be sure that square shaped boss on washer engages square hole in tray.
3. Slide pivot screw up through hole in center of vent door arm.
4. Install compression spring (rubber sleeve), flat washer and locknut on pivot screw.
5. Tighten locknut only until flat washer is snug (does not rotate) and then tighten an additional 1-1/2 turns. Verify proper vent door operation.

NOTE

For best results, the 0.50 in. (12.7 mm) compression spring must be compressed to a height of 0.420 to 0.460 in. (10.7-11.7 mm).

ENGINE GUARD

Removal

1. Remove lower fairings, if present. See 2.36 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU). Remove lower fairing clamps from engine guard.
2. Remove screws (with flanged locknuts) to release ends of engine guard from frame weldments.
3. Remove hex socket screw (with flat washer) to release tab at top of engine guard from slot at base of steering head.

Installation

1. Insert tab at top of engine guard into slot at base of steering head. Start screw (with flat washer).
2. Position ends of engine guard outboard of frame weldments on each side of motorcycle. Install screws positioning flanged locknuts on inboard side of frame weldments.

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3. Tighten three screws to 15-20 ft-lbs (20.3-27.1 Nm).
4. Install lower fairing clamps on each side of engine guard. Install lower fairings, if present. See 2.36 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU).

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UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U 2.37

OUTER FAIRING AND WINDSHIELD

Removal

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. See Figure 2-133. **Loosen** the three screws (1) (with flat washers) just below the windshield.
3. Raise and remove the windshield from between the inner and outer fairings.
4. Remove two screws (2) outboard of the speakers on the left and right side.
5. Remove screws (3) below the fairing cap.

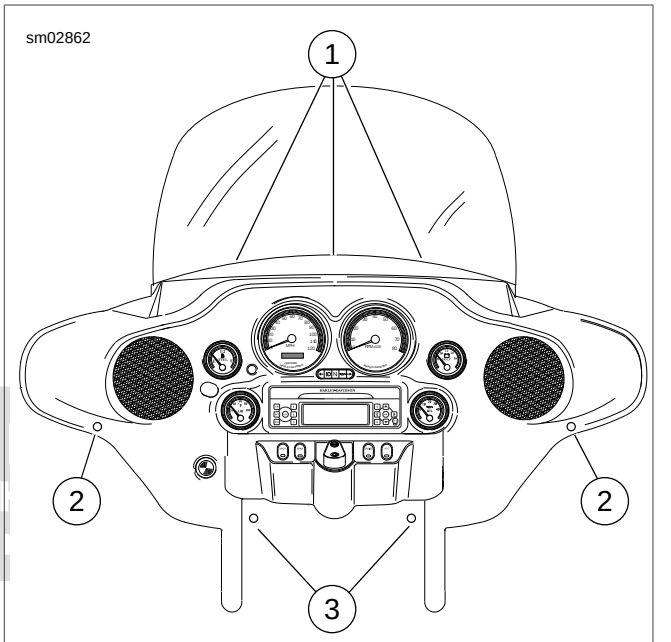
NOTE

On FLHX models, be sure to hold the outer fairing in position as the last screw is removed. Without auxiliary lamps to hold it in position, the outer fairing will drop, possibly resulting in fairing or fender damage.

6. Remove the three screws below the windshield.
7. Tilting the outer fairing forward, remove headlamp connector [38] at the back of the headlamp assembly.
8. Lift the outer fairing off the motorcycle.

Installation

1. Place the outer fairing on the motorcycle and install headlamp connector [38] at the back of the headlamp assembly.
2. See Figure 2-133. Start three screws (1) (with flat washers) just below the windshield.
3. Start two screws (2) outboard of the speakers on the left and right side.
4. Start two screws (3) below the fairing cap.
5. Tighten the four screws on the inner fairing side to 20-30 **in-lbs** (2.3-3.4 Nm).
6. Place the windshield into position between the inner and outer fairings engaging the slotted holes in the windshield with the threaded bosses on the inner fairing.
7. Tighten the three screws below the windshield to 25-30 **in-lbs** (2.8-3.4 Nm).
8. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.



1. **Windshield screws (3)**
2. **Fairing outer screws (2)**
3. **Fairing lower screws (2)**

Figure 2-133. Outer Fairing Screws

FAIRING CAP: FLHX, FLHT/C/U 2.38

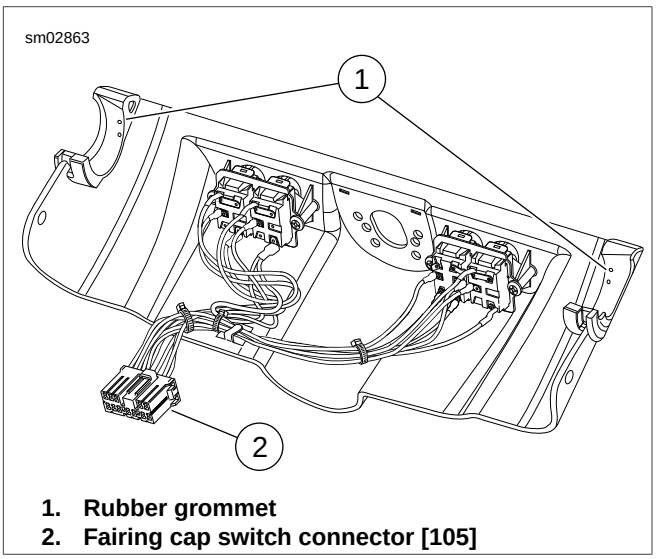
FAIRING CAP

Removal

1. Partially disassemble ignition switch: remove ignition switch knob, spring, nut, collar, spacer and switch position plate. See 7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.
2. Remove two screws (with flat washers) to release fairing cap from left and right sides of inner fairing.
3. With the front forks turned to the left fork stop, disconnect fairing cap switch connector [105] (2), 12-place Multilock (black).
4. See Figure 2-134. Remove fairing cap from motorcycle.

Installation

1. See Figure 2-134. Verify that rubber grommets (1) are installed on each side of fairing cap. Barbs on cap fit into holes in grommets.
2. Connect fairing cap switch connector [105] (2), 12-place Multilock (black).
3. Install fairing cap over ignition switch housing. Verify that grommets in fairing cap fully capture handlebar, handlebar switch conduit, and brake line from front master cylinder reservoir (right side).



1. **Rubber grommet**
2. **Fairing cap switch connector [105]**

Figure 2-134. Fairing Cap Assembly

4. Install two screws (with flat washers) to secure fairing cap. Tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
5. Assemble ignition switch: install switch position plate, spacer, collar, nut, spring and knob. See 7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.

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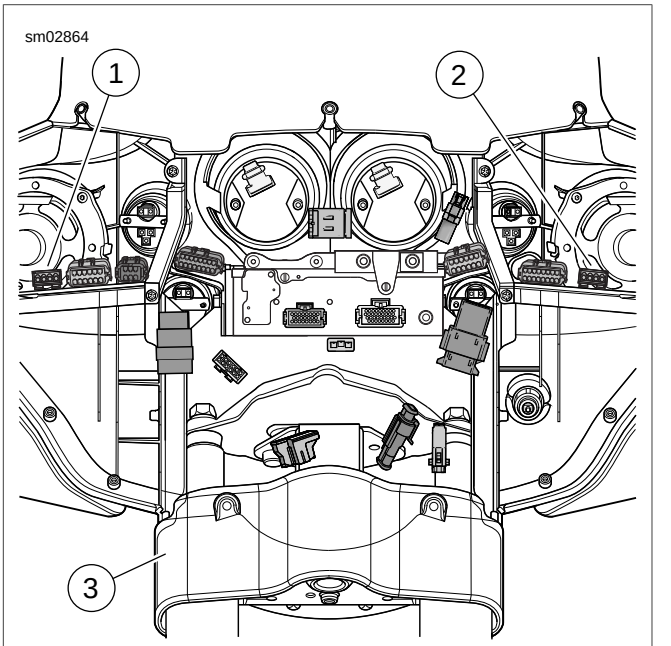
INNER FAIRING: FLHX, FLHT/C/U 2.39

REMOVAL

NOTE

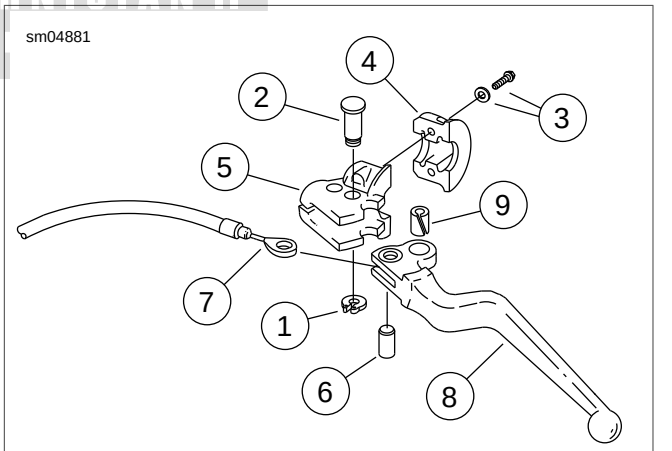
To avoid scratches or other damage, place protective material over front fender, fuel tank and lower fairings, if present.

1. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, Outer Fairing and Windshield.
2. See Figure 2-135. Disconnect left (2) and right (1) front turn signal/auxiliary lamp connectors [31L/R] (4-place Multilocks).
3. Remove four screws to release auxiliary lamp bracket from upper and lower fork brackets.
4. Remove fairing cap. See 2.38 FAIRING CAP: FLHX, FLHT/C/U, Fairing Cap.
5. See Figure 2-135. Pull chrome skirt from inner fairing.
6. Slide rubber boot off clutch cable adjuster. Holding cable adjuster with 1/2 inch wrench, loosen jam nut using 9/16 inch wrench. Back jam nut away from cable adjuster. Move adjuster toward jam nut to introduce free play at hand lever.
7. See Figure 2-136. Remove retaining ring (1). Remove pivot pin (2).
8. Remove two screws (with flat washers) (3) to release handlebar clamp (4) from clutch lever bracket (5). Remove clutch hand lever (8) from clutch lever bracket.
9. Remove anchor pin (6) and clutch cable eyelet from clutch hand lever.
10. Feed clutch cable through inner fairing grommet to front of motorcycle.
11. See Figure 2-137. Remove cigarette lighter from socket. Pull socket terminals [132] from spade contacts on socket and outer shell. Holding socket to prevent rotation, remove outer shell. Remove socket from inner fairing.
12. Pull socket terminals [35] from left side speaker spade contacts. Remove three screws to release speaker adapter from inner fairing. Repeat step on right side of motorcycle.
13. Remove rubber boot from odometer reset switch. Pull switch from hole in inner fairing.
14. See Figure 2-137. Disconnect speedometer [39] and tachometer [108] gauge connectors. Leaving anchors on interconnect harness installed in ears of brackets, if present, remove screws to release brackets from gauges. Remove gauges from inner fairing.



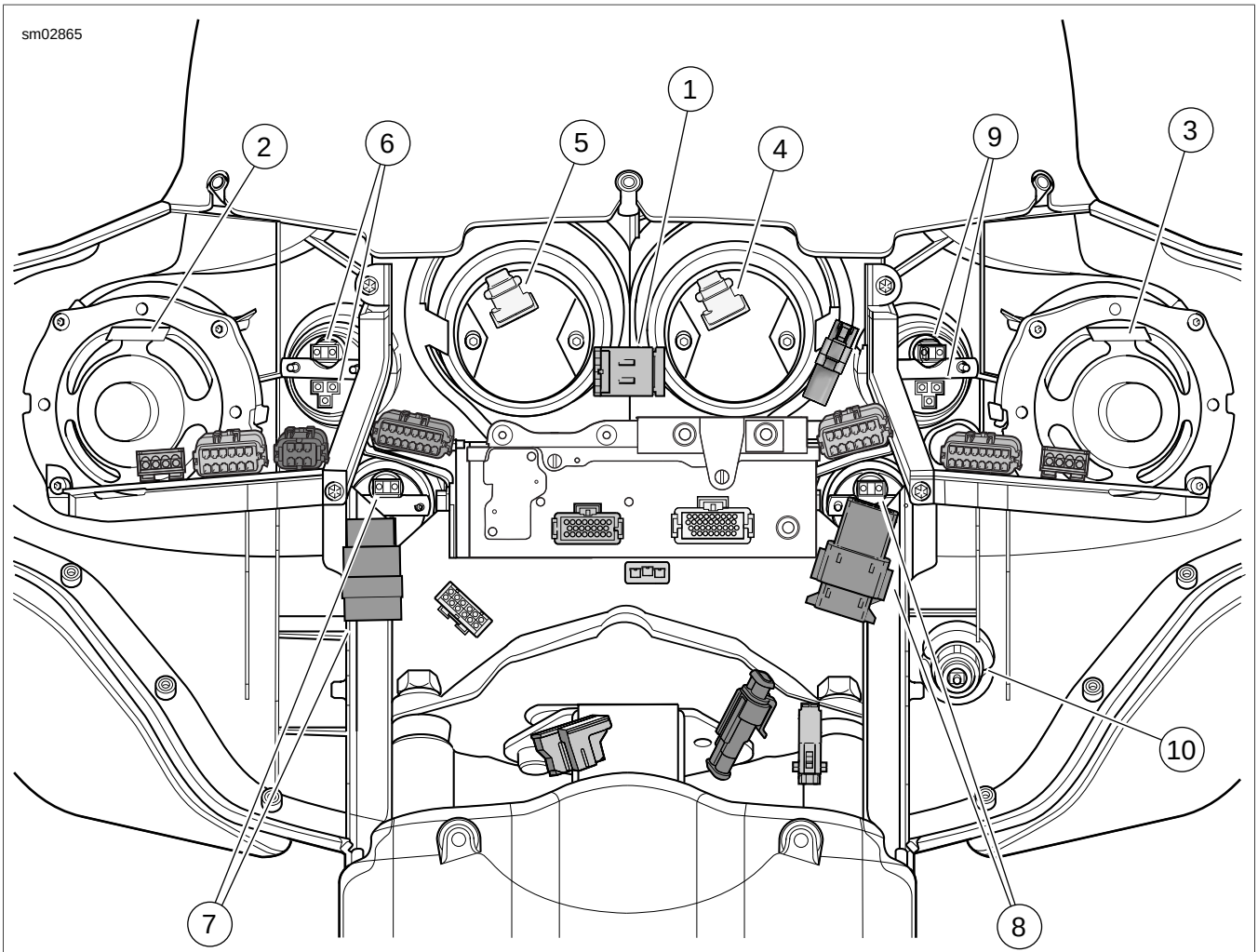
1. **Right front turn signal/auxiliary lamp [31R]**
2. **Left front turn signal/auxiliary lamp [31L]**
3. **Chrome skirt**

Figure 2-135. Inner Fairing (Front View)



1. **Retaining ring**
2. **Pivot pin**
3. **Screw (with flat washer)**
4. **Handlebar clamp**
5. **Clutch lever bracket**
6. **Anchor pin**
7. **Clutch cable eyelet**
8. **Hand lever**
9. **Bushing**

Figure 2-136. Disconnect Clutch Cable From Hand Lever



1. **Indicator lights [21]**
2. **Right front speaker [34]**
3. **Left front speaker [35]**
4. **Speedometer [39]**
5. **Tachometer [108]**
6. **Voltmeter gauge [111] and lamp [110]**
7. **Oil pressure gauge [113] and lamp [112]**
8. **Air temperature gauge [115] and lamp [114]**
9. **Fuel gauge [117] and lamp [116]**
10. **Cigarette lighter [132]**

Figure 2-137. Inner Fairing Connectors (FLHX, FLHT/C/U)

15. See Figure 2-137. Disconnect indicator lights connector [21], 10-place Multilock. Release each paddle on lens from between pair of index tabs on indicator lights assembly. Remove lens from inner fairing.
16. Disconnect voltmeter gauge [111] and lamp [110] connectors. Disconnect fuel gauge [117] and lamp [116] connectors.
17. See Figure 2-138. Remove four screws to free inner fairing from fairing bracket.
18. Spread bottom of inner fairing and fairing bracket to free from threaded dowels in lower fork bracket. Raise inner fairing and fairing bracket slightly to prevent re-engagement with dowels.
19. **Classic and Ultra models:** Disconnect oil pressure gauge [113] and lamp [112] connectors. Disconnect air temperature gauge [115] and lamp [114] connectors.
20. Raise inner fairing and fairing bracket together and then separate by pulling fairing bracket toward the front and inner fairing toward the rear.
21. When inner fairing becomes free of the radio, remove from motorcycle.
22. Install fairing bracket (with radio and interconnect harness) back onto motorcycle aligning holes with threaded dowels in lower fork bracket. Loosely install screws to secure fairing bracket to lower fork bracket.
23. Remove hex nuts from studs at back of voltmeter and fuel gauges. Remove mounting brackets from gauges and remove gauges from inner fairing. On Classic and Ultra models, repeat step to remove oil pressure and air temperature gauges.
24. Remove clutch cable grommet from inner fairing.

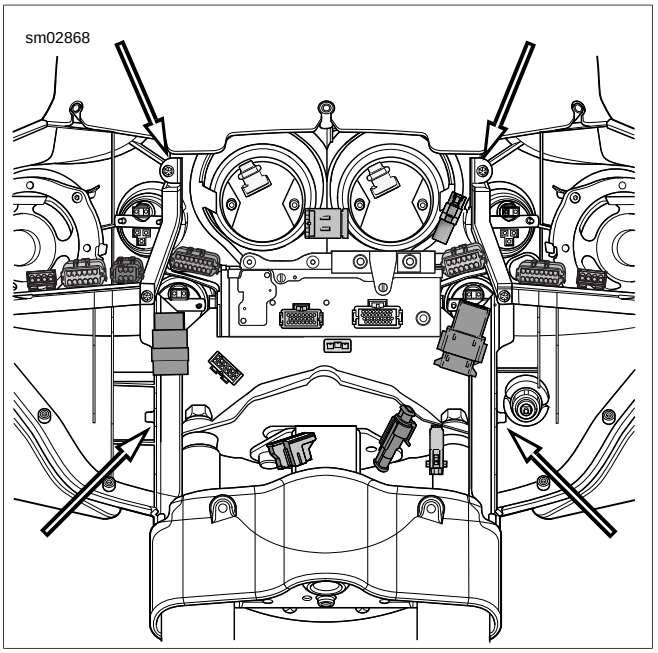


Figure 2-138. Remove Fairing Bracket Screws

INSTALLATION

1. Install clutch cable grommet in inner fairing.
2. See Figure 2-139. Install voltmeter and fuel gauges in inner fairing. Slide mounting brackets over studs. Verify that tabs on top and bottom of brackets engage slots in inner fairing. Loosely install hex nuts on studs. Verify that gauge is properly aligned and tighten nuts to 10-20 **in-lbs** (1.1-2.3 Nm).
3. **Classic and Ultra models:** Repeat last step to install air temperature and oil pressure gauges.

NOTE

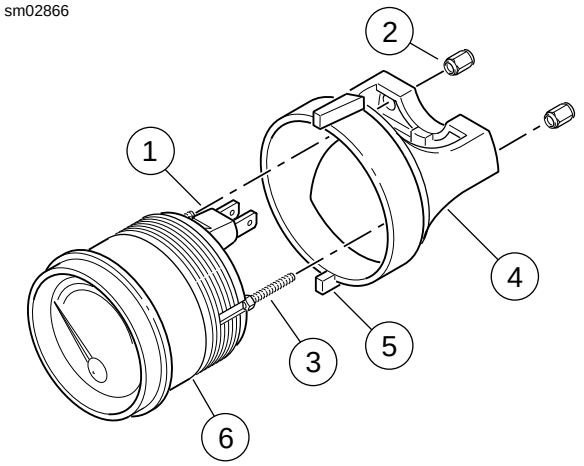
To avoid scratches or other damage, place protective material over front fender, fuel tank and lower fairings, if present.

4. Remove fairing bracket (with radio and interconnect harness) from lower fork bracket. Raise fairing bracket and then tilt forward at a 45 degree angle.
5. Position inner fairing at rear of fairing bracket. Align upper and lower fork bracket through holes with those in fairing bracket. Draw fairing bracket and inner fairing together fitting radio into slot of inner fairing.
6. Align upper through holes in fairing bracket and inner fairing with threaded holes in bosses of upper fork bracket and start two screws. Align lower through holes in fairing bracket and inner fairing with threaded dowels in lower fork bracket and start two screws. Alternately tighten four screws until snug.
7. See Figure 2-138. Install four screws to fasten inner fairing to fairing bracket.
8. See Figure 2-137. Connect voltmeter gauge and lamp connectors (6). Connect fuel gauge and lamp connectors (9).
9. **Classic and Ultra models:** Connect oil pressure gauge and lamp connectors (7). Connect air temperature gauge and lamp connectors (8).
10. See Figure 2-140. Install lens of indicator lights, so that bottom slot engages index tab in inner fairing. With the word "TOP" facing up, engage each paddle on lens between pair of index tabs on indicator lights assembly. Connect indicator lights connector (1).
11. Install speedometer and tachometer gauges in inner fairing. Align holes in brackets with those in gauges and start two screws. Rotate brackets until top and bottom tabs engage slots in inner fairing. Verify that gauges are properly aligned and tighten screws to 10-20 **in-lbs** (1.1-2.3 Nm). Connect speedometer (4) and tachometer (5) gauge connectors.
12. Slide odometer reset switch through hole in inner fairing and install rubber boot.
13. With the widest edge at the top, align holes in speaker adapter with those in inner fairing. Install two long screws at top of speaker adapter. Capturing fairing support brace, install short screw in lower outboard hole (positioning flat washer between adapter and support brace). Tighten lower screw to 22-28 **in-lbs** (2.5-3.2 Nm). Tighten two upper screws to 35-50 **in-lbs** (4.0-5.7 Nm).

NOTE

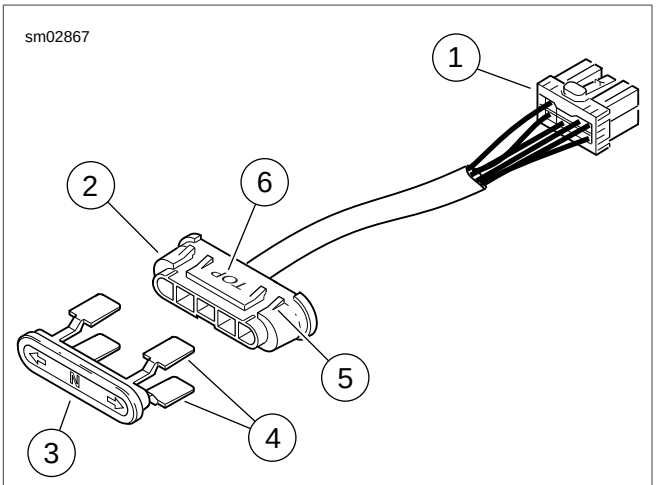
The screw hole on the lower inboard side of the speaker adapter is not used.

14. Install socket terminals onto speaker spade contacts. Different size spade contacts prevent improper assembly.
15. Repeat last two steps on opposite side of motorcycle.
16. Slide socket of cigarette lighter through hole in inner fairing. Thread outer shell onto socket until tight. Install cigarette lighter in socket. Connect the orange/white wire terminal to the socket spade contact, the black wire terminal to the outer shell contact.
17. Feed clutch cable through inner fairing grommet.
18. Insert clutch cable eyelet into groove of clutch hand lever aligning eyelet with hole without bushing. Insert anchor pin through lever and eyelet.
19. Insert lever into groove of clutch lever bracket fitting sleeve at end of cable housing into bore on inboard side of bracket.
20. Align hole in hand lever with hole in bracket and install pivot pin. Install retaining ring in pivot pin groove.
21. Install two screws (with flat washers) to secure handlebar clamp to clutch lever bracket. Starting with the top screw, tighten screws to 72-108 **in-lbs** (8-12 Nm).
22. Adjust clutch. See 1.11 CLUTCH.
23. Install fairing cap. See 2.38 FAIRING CAP: FLHX, FLHT/C/U.
24. See Figure 2-135. Remove two screws from lower fork bracket. Install chrome skirt aligning through holes with those in lower fork bracket. Reinstall screws.
25. Loosen two screws in upper fork bracket.



1. **Pin housing**
2. **Hex nut**
3. **Stud**
4. **Mounting bracket**
5. **Tab**
6. **Gauge**

Figure 2-139. 2 Inch Diameter Gauges



1. **Indicator lamp connector [21]**
2. **Indicator lamp assembly**
3. **Lens**
4. **Paddles**
5. **Index tabs**
6. **Orientation stamp**

Figure 2-140. Indicator Lamp Assembly

26. Slide slots of auxiliary lamp bracket onto upper and lower fork bracket screws. Alternately tighten four screws to 15-20 ft-lbs (20-27 Nm) in a crosswise pattern.
27. See Figure 2-135. Mate left and right front turn signal/auxiliary lamp connectors (1,2). Install on T-studs at top of left and right fairing support braces (outboard side). Verify that conduit is routed inboard using relief in upper outboard corner of chrome skirt.
28. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

DIGITAL TECHNICIAN HARLEY-DAVIDSON

AIR DEFLECTORS 2.40

AIR DEFLECTORS (FLHTCU)

Removal

1. See Figure 2-141. Remove four screws to release air deflector at side of inner fairing.
2. Repeat step to remove air deflector on opposite side of motorcycle.

Installation

1. Install four screws to fasten air deflector at side of inner fairing. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
2. Repeat step to install air deflector on opposite side of motorcycle.

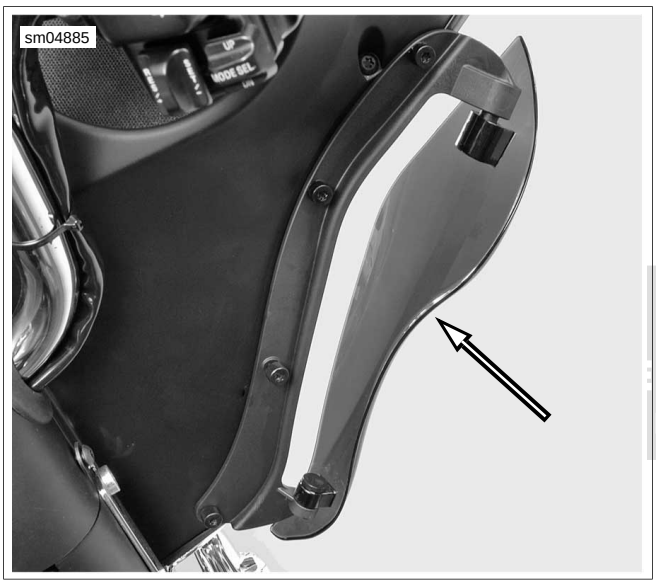


Figure 2-141. Air Deflector (Adjustable)

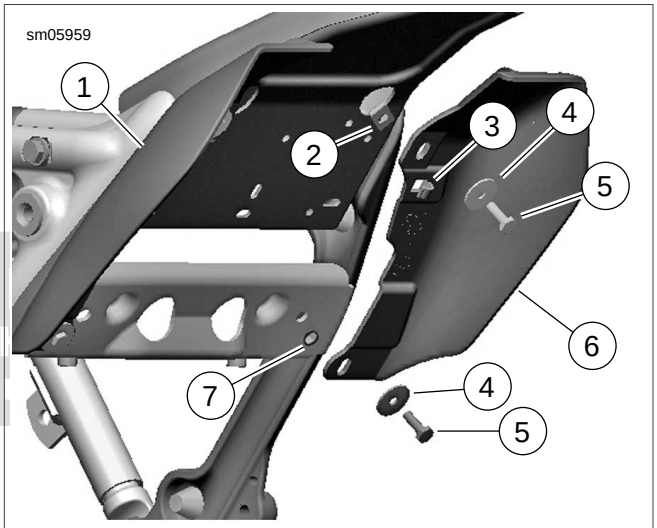
MID-FRAME AIR DEFLECTORS

Removal

1. See Figure 2-142. Release spark plug wire from retainer (3) (left deflector only).
2. Remove bolts (5) and washers (4).
3. Remove deflector (6) from frame.

Installation

1. See Figure 2-142. Verify clip nut (2) is installed in frame hole.
2. Install left air deflector (6) with washers (4) and bolts (5). Tighten bolts to 25-35 **in-lbs** (2.8-4.0 Nm).
3. Secure spark plug wire in retainer (3).



1. **Right air deflector**
2. **Clip nut (2)**
3. **Rear spark plug wire retainer**
4. **Washer (4)**
5. **Bolt (4)**
6. **Left air deflector**
7. **Clinch nut (2)**

Figure 2-142. Air Deflectors

UPPER FAIRING AND WINDSHIELD: FLTR 2.41

WINDSHIELD

Removal

1. Alternately loosen and then remove five screws (with plastic flat washers) at base of windshield.
2. Remove windshield from outer fairing.
3. See Figure 2-143. Carefully remove wellnuts (with rubber flat washers) from holes in outer fairing.

NOTE

Exercise caution to avoid pushing wellnuts into fairing during removal. Inspect wellnuts and rubber flat washers for cuts, tears or signs of deterioration. Replace as necessary.

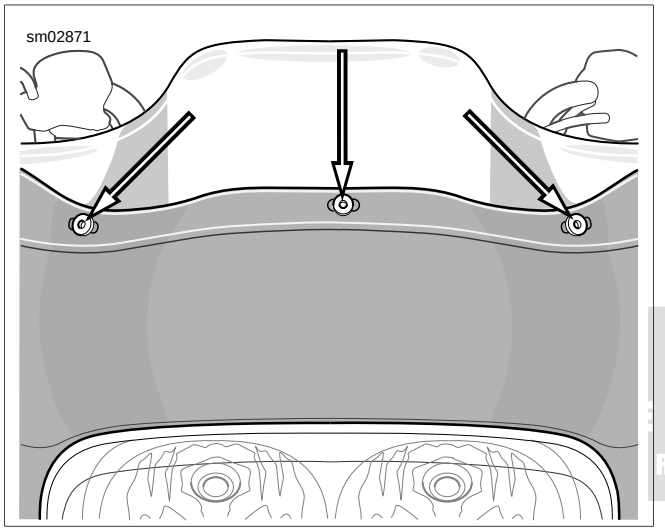
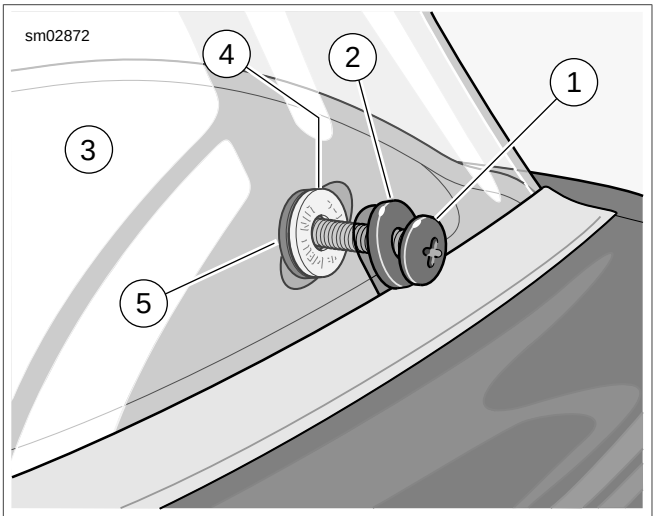


Figure 2-143. Remove Wellnuts from Outer Fairing

Installation

1. **Preinstall** hardware on windshield as follows:
 a. Slide plastic flat washers onto screws.
 b. Slide screws through slots in windshield.
 c. Slide rubber flat washers onto wellnuts.
 d. Start wellnuts onto screws.
2. See Figure 2-144. Push wellnuts into holes in outer fairing.
3. Starting with center screw, alternately tighten five screws to 6-13 **in-lbs** (0.7-1.5 Nm).



1. **Screw**
2. **Plastic flat washer**
3. **Windshield**
4. **Wellnut**
5. **Rubber flat washer**

Figure 2-144. Install Windshield

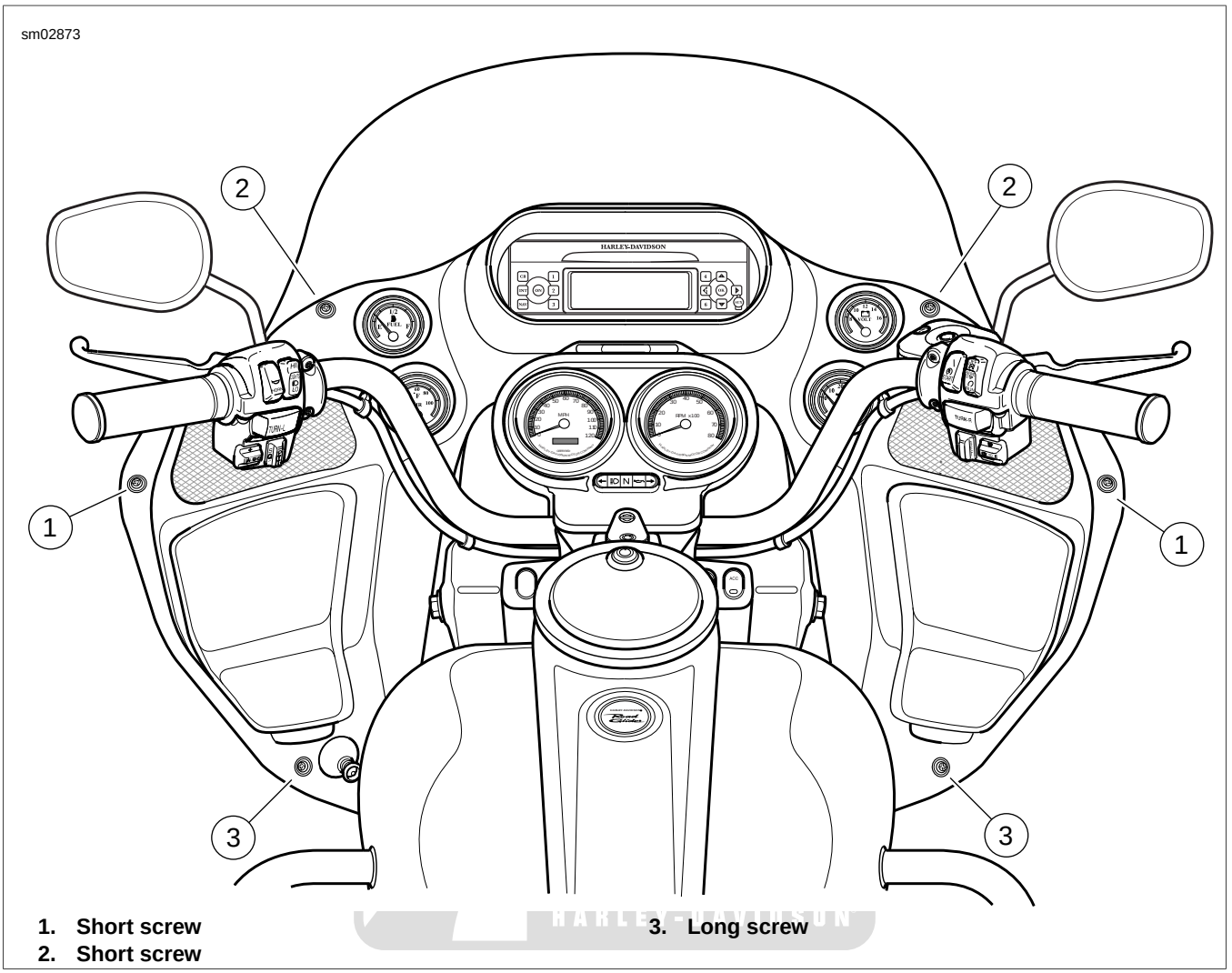
OUTER FAIRING

Removal

NOTE

Windshield may be left in place during outer fairing removal.

1. Place protective material on top of front fender to protect paint from scratches or other damage.
2. See Figure 2-145. Remove screw at edge of fairing outboard of left speaker. Remove screw outboard of right speaker.
3. **Loosen** top left and right screws just outboard of the fuel and volt gauges, respectively.
4. Remove screw just below left side glove compartment. Remove screw below right side glove compartment.
5. See Figure 2-146. On inboard side of right fairing support, remove rear acorn nut (with flat washer) from stud of front turn signal lamp bracket. Remove front acorn nut with flat washer.
6. Pull front turn signal lamp assembly from motorcycle and allow to hang at front of engine guard. Repeat step to remove front turn signal lamp assembly on left side.



1. **Short screw**
2. **Short screw**
3. **Long screw**

Figure 2-145. Fairing Screw Torque Sequence

7. Remove top left and right screws just outboard of the fuel and volt gauges, respectively (previously loosened).
8. Raise outer fairing slightly and then rest on protective fender pad.
9. Squeeze two external tabs to disconnect headlamp jumper harness connector.
10. See Figure 2-147. To avoid possible wire damage, disconnect front turn signal lamp connectors.

Installation

1. Place protective material on top of front fender to protect paint from scratches or other damage.
2. Connect front turn signal lamp connectors. Capture conduit in adhesive clips on inner fairing. Allow front turn signal lamp assemblies to hang at front of engine guard until outer fairing installation is complete.

NOTE

The front turn signal lamp assemblies are not interchangeable. Note that the letters R(ight) or L(eft) are stamped on the inboard side of the turn signal lamp bracket to help verify proper assembly.

3. To avoid chafing wires of interconnect harness, verify that trim strips are installed inboard of hooks on radio bracket.
4. Rest outer fairing on front fender pad and connect headlamp jumper harness connector.
5. Place outer fairing against inner fairing. Two slots in outer fairing must engage hooks on radio bracket. Move harness conduit and wiring as necessary to verify full engagement between outer and inner fairings.

NOTE

If windshield is attached during outer fairing installation, exercise caution to avoid scratching or damaging inner fairing with windshield screws and wellnuts.

6. Move to side of outer fairing to verify that alignment tabs are properly engaged. Alignment tabs on inner fairing must be positioned outboard of those on the outer fairing. Repeat step on opposite side of motorcycle.

NOTE

Although the tightening sequence described below begins on the left side of the motorcycle, install the first screw on the side that does ***not*** *have the best fit.*

7. Install screw at edge of fairing outboard of the left speaker. Install screw outboard of the right speaker. Mounting bosses on inner fairing are painted white for easier alignment of holes.
8. Install the top left and right screws just outboard of the fuel and volt gauges, respectively.
9. Moving to left side of motorcycle, install the first of two long screws just below the glove compartment. Install the second long screw below the right side glove compartment.
10. Tighten screws in sequence shown in Figure 2-145. Tighten four short screws to 6-12 **in-lbs** (0.7-1.4 Nm). Tighten two long screws to 10-15 **in-lbs** (1.1-1.7 Nm).
11. Slide studs on front turn signal lamp bracket through holes in fairings and fairing support. Loosely install acorn nuts with flat washers. Alternately tighten acorn nuts to 40-50 **in-lbs** (4.5-5.7 Nm).
12. Repeat last step to install front turn signal lamp assembly on opposite side of motorcycle.

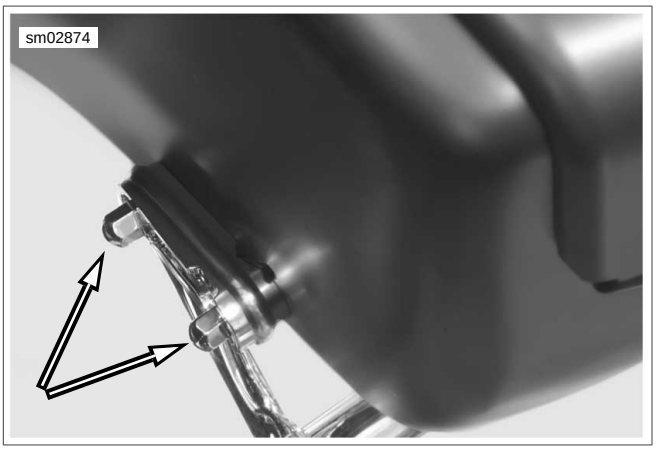


Figure 2-146. Remove Acorn Nuts to Release Turn Signal Lamp and Bracket



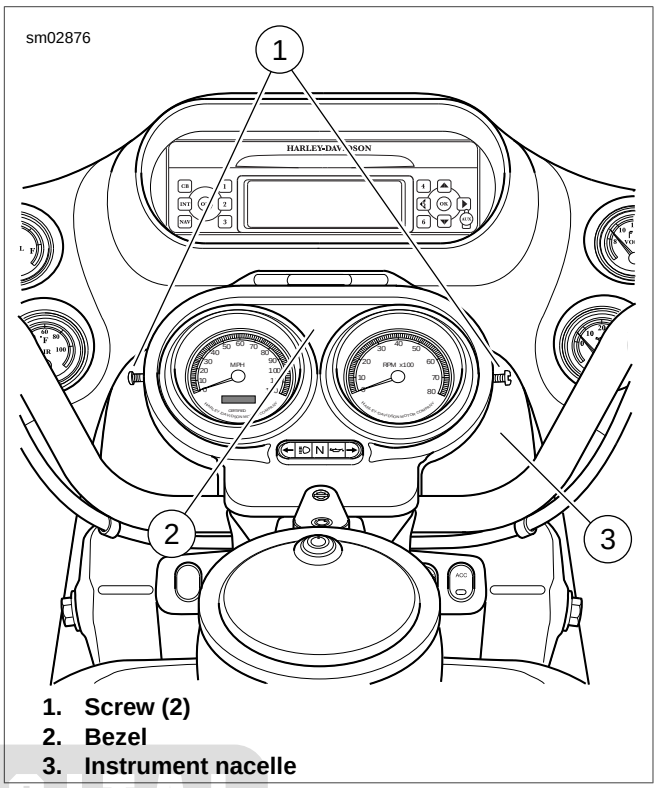
Figure 2-147. Front Turn Signal Lamp

INSTRUMENT BEZEL: FLTR 2.42

BEZEL

Removal

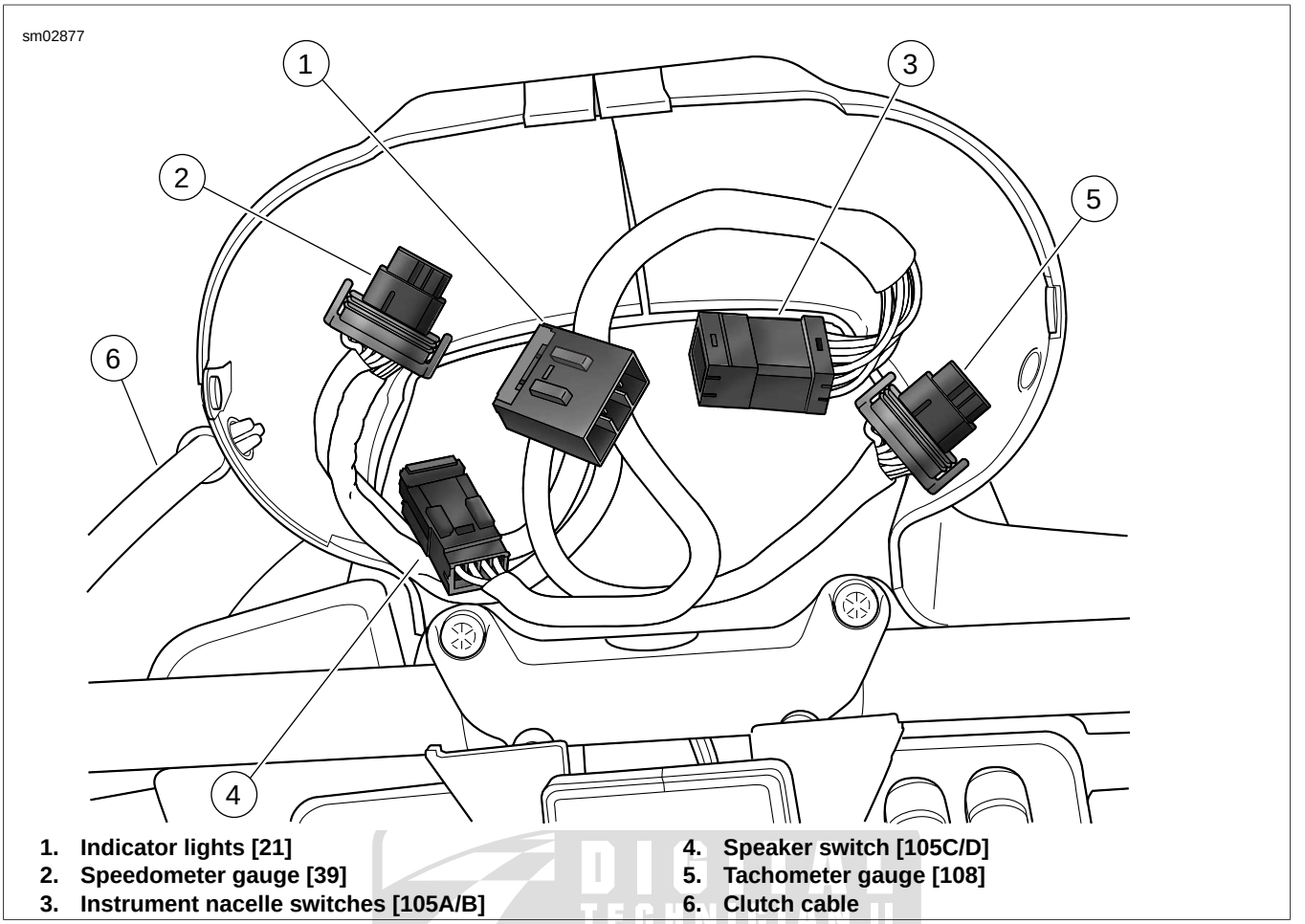
1. See Figure 2-148. Remove screw on each side of bezel.
2. Use thumbs to push tab at rear of bezel from slot in front of ignition switch. Gently raise free side of bezel until tabs at front of instrument nacelle become disengaged from slot at front of bezel (concealed behind decorative adhesive strip).



1. Screw (2)
2. Bezel
3. Instrument nacelle

Figure 2-148. Remove Bezel Screws

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Indicator lights [21]**
2. **Speedometer gauge [39]**
3. **Instrument nacelle switches [105A/B]**
4. **Speaker switch [105C/D]**
5. **Tachometer gauge [108]**
6. **Clutch cable**

Figure 2-149. Instrument Nacelle (Bezel Removed)

3. See Figure 2-149. Raising bezel slightly, disconnect instruments and indicator lights from interconnect harness as follows:
 a. Speedometer connector [39], 12-place Packard.
 b. Tachometer connector [108], 12-place Packard.
 c. Indicator lights connector [21], 10-place Multilock.
4. Remove bezel from motorcycle.

Installation

1. See Figure 2-149. Looking into the instrument nacelle, connect instruments and indicator lights to interconnect harness as follows:
 a. Speedometer connector [39], 12-place Packard.
 b. Tachometer connector [108], 12-place Packard.
 c. Indicator lights connector [21], 10-place Multilock.
2. Verify that left and right sides of instrument nacelle are properly mated. Pins on left side of nacelle must fully engage holes on right.
3. Insert tab at rear of bezel into slot of instrument nacelle (just in front of ignition switch). Holding left and right sides of nacelle together, place bezel over instrument nacelle flange. When properly mated, tabs at front of instrument nacelle engage lip in slot at front of bezel (behind decorative adhesive strip).

NOTE

*If tabs do not properly engage slot at front of bezel, then a loose fit will result. Remove decorative adhesive strip by gently prying up outer edges, and using a flat bladed screwdriver, carefully raise tabs so that they engage lip in slot. If damaged, install **new** decorative adhesive strip.*

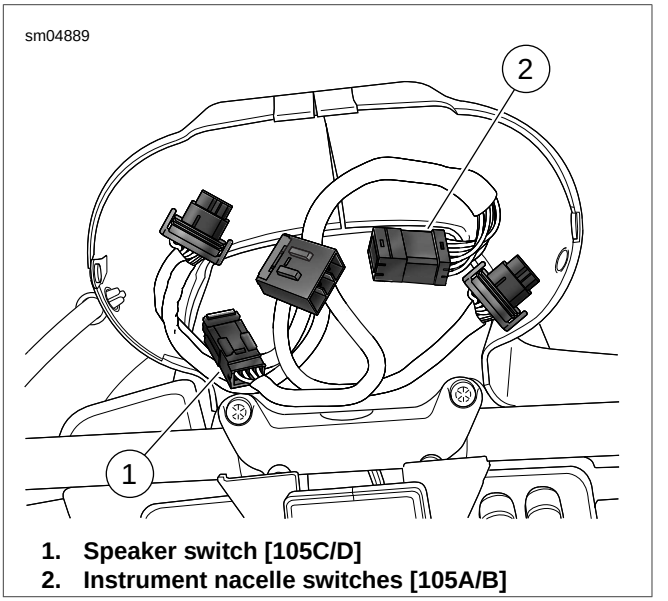
4. See Figure 2-148. Install screw on each side of bezel. Alternately tighten screws to 25-35 **in-lbs** (2.8-4.0 Nm).

INSTRUMENT NACELLE: FLTR 2.43

INSTRUMENT NACELLE

Removal

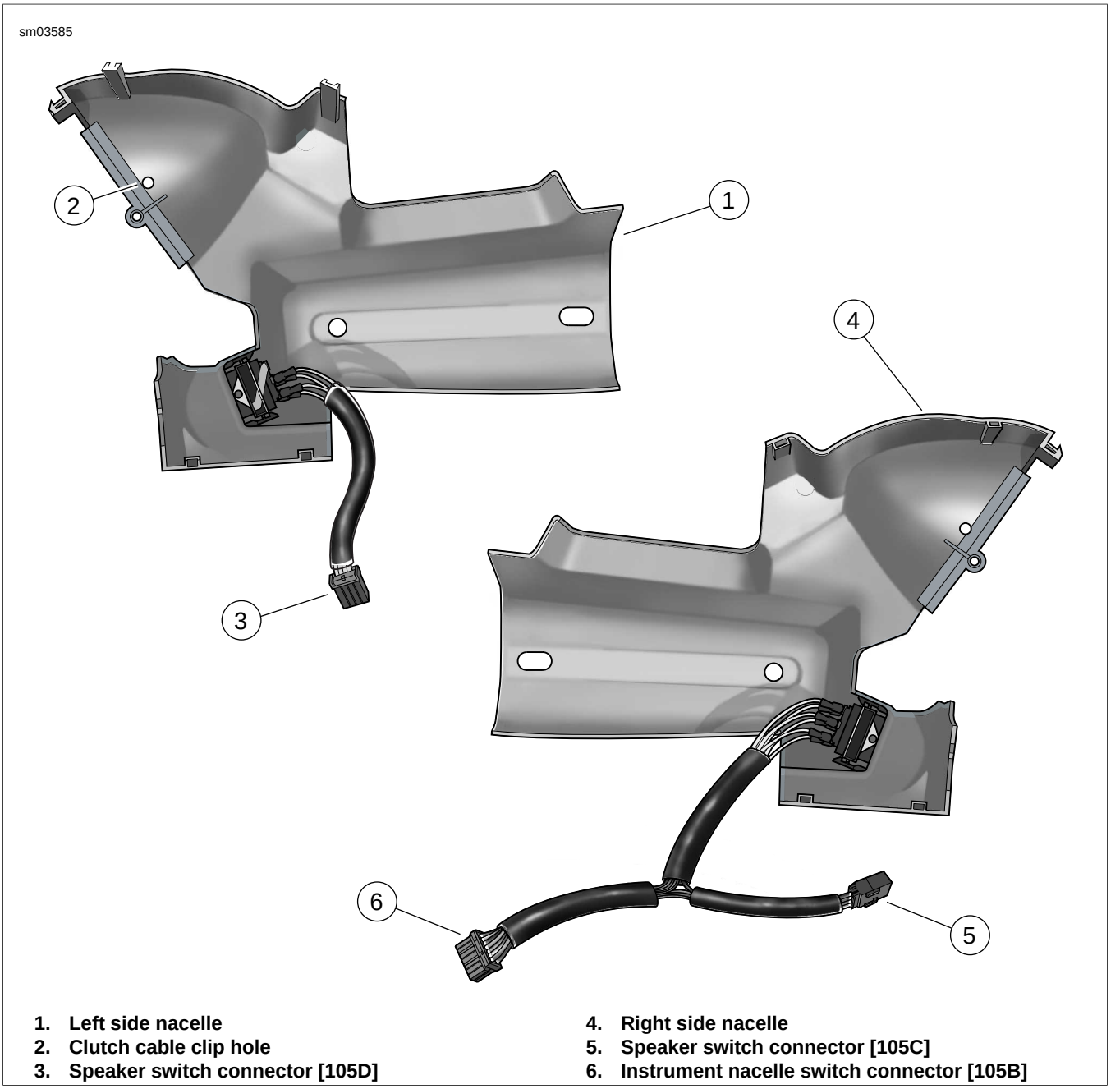
1. Partially disassemble ignition switch: remove ignition switch knob, spring, nut, collar, spacer and switch position plate. See 7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.
2. Remove bezel. See 2.42 INSTRUMENT BEZEL: FLTR.
3. See Figure 2-149. Disconnect speaker switch connector [105C/D], 4-place Multilock, from instrument nacelle switch harness.
4. Pull clutch cable clip from hole on left side of instrument nacelle.
5. See Figure 2-151. Remove two screws (with flat washers) to release left side of instrument nacelle from upper and lower fork brackets.
6. Remove rubber boot from odometer reset switch, and while carefully removing left side instrument nacelle from motorcycle, pull odometer reset switch from hole.
7. See Figure 2-149. Disconnect instrument nacelle switch connector [105A/B], 12-place Multilock, from interconnect harness.
8. See Figure 2-151. Remove two screws (with flat washers) to release right side of instrument nacelle from upper and lower fork brackets.



1. Speaker switch [105C/D]
2. Instrument nacelle switches [105A/B]

Figure 2-150. Instrument Nacelle Connectors

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Left side nacelle**
2. **Clutch cable clip hole**
3. **Speaker switch connector [105D]**
4. **Right side nacelle**
5. **Speaker switch connector [105C]**
6. **Instrument nacelle switch connector [105B]**

Figure 2-151. Instrument Nacelle Halves

Installation

1. Install right side of instrument nacelle on motorcycle.
2. See Figure 2-149. Connect instrument nacelle switch connector [105A/B], 12-place Multilock, to interconnect harness.
3. While carefully placing left side of instrument nacelle on motorcycle, slide odometer reset switch through hole and install rubber boot.
4. See Figure 2-149. Connect speaker switch connector [105C/D], 4-place Multilock, to instrument nacelle switch harness.
5. Verify that left and right sides of nacelle are properly mated. Four pins on left side of nacelle must fully engage holes on right.
6. Install two screws (with flat washers) to fasten left side instrument nacelle to upper and lower fork brackets. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm).
7. Capture clutch cable in cable clip. Insert cable clip into hole in left side of instrument nacelle.
8. Install two screws (with flat washers) to fasten right side instrument nacelle to upper and lower fork brackets. Tighten screws to 15-20 ft-lbs (20-27 Nm).
9. Install bezel. See 2.42 INSTRUMENT BEZEL: FLTR.

10. Assemble ignition switch: install switch position plate, spacer, collar, nut, spring and knob. See 7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.

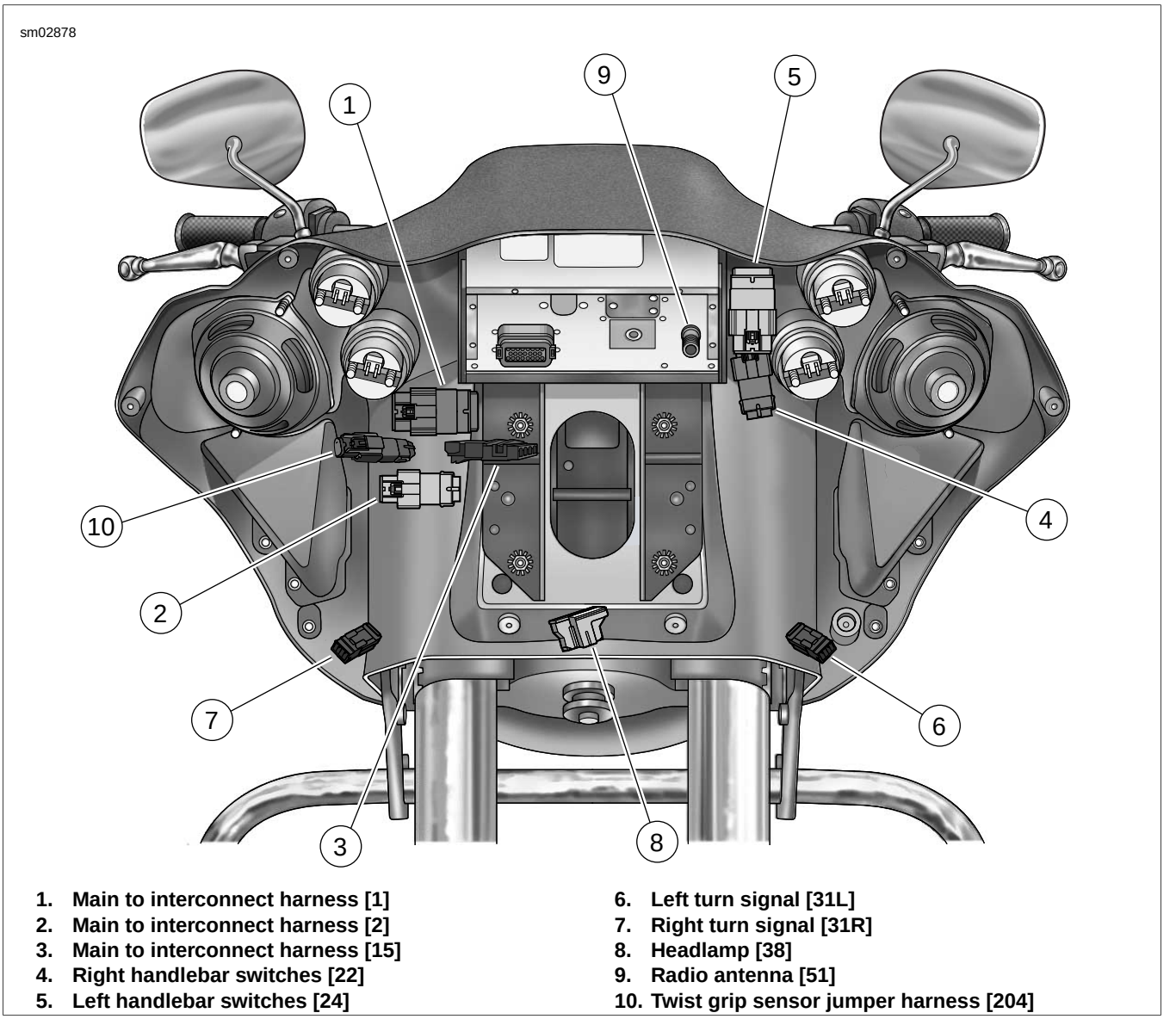
DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

INNER FAIRING: FLTR 2.44

REMOVAL

PART NUMBER	TOOL NAME
HD-45961	IGNITION SWITCH CONNECTOR REMOVER

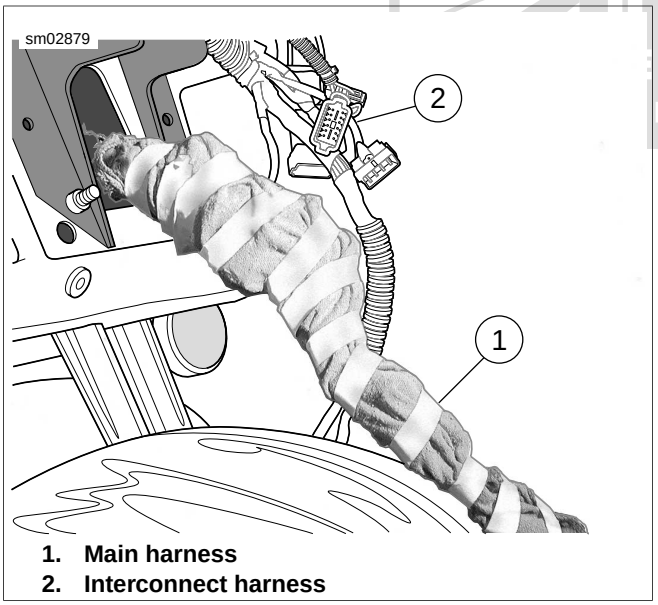
1. Place protective material on top of front fender to protect paint from scratches or other damage.
2. Remove outer fairing. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
3. Carefully cut two cable straps to free wire bundles and conduit from convoluted tubing of interconnect harness and allow to hang naturally.
4. See Figure 2-152. Disconnect main harness from interconnect harness as follows:
 a. Main to interconnect harness connector [1], 16-place Molex (black); below radio (right side).
 b. Main to interconnect harness connector [2], 12-place Molex (gray); below radio (right side).
 c. Main to interconnect harness connector [15], 4-place Packard (black); below radio (right side).
5. Disconnect radio antenna cable connector [51] at back of radio (left side).
6. Disconnect twist grip sensor jumper harness connector [204], 6-place Molex (black), from main harness.



1. **Main to interconnect harness [1]**
2. **Main to interconnect harness [2]**
3. **Main to interconnect harness [15]**
4. **Right handlebar switches [22]**
5. **Left handlebar switches [24]**
6. **Left turn signal [31L]**
7. **Right turn signal [31R]**
8. **Headlamp [38]**
9. **Radio antenna [51]**
10. **Twist grip sensor jumper harness [204]**

Figure 2-152. Inner Fairing Connectors (FLTR)

7. See Figure 2-152. Disconnect handlebar switches from interconnect harness. Proceed as follows:
 a. Left handlebar switch connector [24], 16-place Molex (gray); T-stud on left side of radio bracket.
 b. Right handlebar switch connector [22], 12-place Molex (black); T-stud on left side of radio bracket.
8. Remove interconnect harness ground socket terminal from spade contact at front of upper fork bracket (left side).
9. Draw the main harness conduit, radio antenna cable, twist grip sensor jumper harness conduit, and handlebar switch conduit as far forward as possible. Rest the connectors of the longer harnesses on the front fender.
10. Remove left side of instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.
11. Disconnect instrument nacelle switch connector [105A/B], 12-place Multilock, from interconnect harness.
12. Disconnect ambient temperature sensor connector [107], 3-place Multilock, from sensor anchored in hole on left side of steering head. Feed connector and conduit in through opening on left side of fairing bracket.
13. See Figure 2-149. Draw branches of interconnect harness (terminating in odometer reset switch and speedometer, tachometer, indicator lights, instrument nacelle switches and ambient temperature sensor connectors) through tunnel of fairing bracket to front of inner fairing.



1. **Main harness**
2. **Interconnect harness**

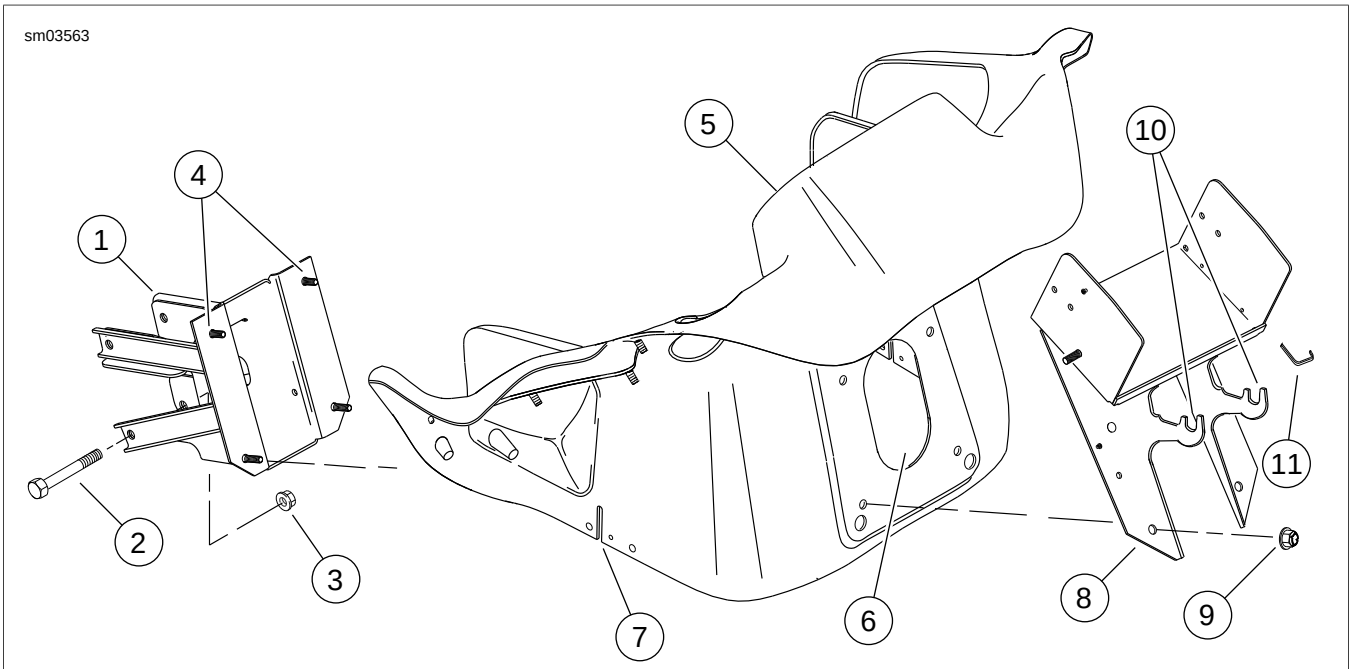
Figure 2-153. Wrap Main Harness in Shop Towels

14. Disconnect ignition switch connector [33], 3-place Packard, at front of ignition switch housing. Proceed as follows:
 a. Obtain the IGNITION SWITCH CONNECTOR REMOVER (Part No. HD-45961).
 b. Gently insert end of tool into slot in ignition switch housing until it stops.
 c. Grasping main harness conduit and tool, pull both at the same time to release socket housing from ignition switch housing.
15. Draw branch of main harness terminating in ignition switch connector from instrument nacelle through tunnel of fairing bracket to front of inner fairing.
16. Separate any branches of the interconnect harness that may be intermingled with the main harness conduit. Allow the interconnect harness to hang along the left side of the front fender.
17. See Figure 2-153. Capturing all connectors, tightly wrap clean shop towels around the main harness conduit, radio antenna cable, twist grip sensor jumper harness conduit, and handlebar switch conduit, and secure with masking tape.
18. See Figure 2-154. Remove four locknuts to release radio bracket and inner fairing from studs of fairing bracket.
19. Lift inner fairing (with attached radio bracket and interconnect harness) from fairing bracket studs and move to bench area.

NOTE

To remove the fairing bracket, proceed with remaining steps.

20. Remove right side instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.
21. Remove shop towels and masking tape from around the harness bundle. Separate main harness conduit, radio antenna cable, twist grip sensor jumper harness conduit, and handlebar switch conduit.
22. Pull main harness conduit, terminating in the radio antenna cable [51], twist grip sensor jumper harness [204], ignition switch [33], and main to interconnect harness connectors, [1] and [15], out through opening on right side of fairing bracket. Hang conduit and connectors over top of engine guard.
23. Pull cable to draw front wheel speed sensor connector [167], 2-place Amp (Tyco), out through opening on left side of fairing bracket. Disconnect from main harness if ABS equipped.
24. Continue pulling main harness conduit to draw main to interconnect harness connector [2] out left side of fairing bracket. Hang conduit and connectors over top of engine guard.
25. Pull handlebar switch conduit and twist grip sensor jumper harness conduit out through opening at top of fairing bracket.
26. Remove locknuts and bolts to release fairing bracket from holes at rear of steering head.



1. **Fairing bracket**
2. **Bolt**
3. **Locknut**
4. **Studs**
5. **Inner fairing**
6. **Opening**
7. **Slot**
8. **Radio bracket**
9. **Locknut**
10. **Outer fairing hooks**
11. **Trim strip**

Figure 2-154. Inner Fairing Assembly

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

INSTALLATION

Outer Fairing

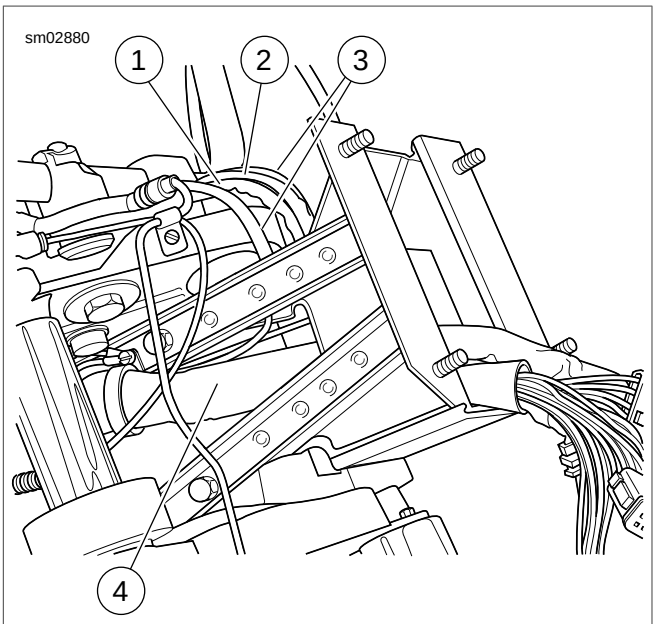
1. Align holes in fairing bracket with those at rear of steering head. Standing on right side, insert bolts until they exit fairing bracket on left side of motorcycle. Install locknuts and tighten to 20-30 ft-lbs (27.1-40.7 Nm).
2. See Figure 2-155. Route handlebar switch conduit and twist grip sensor jumper harness conduit in through opening at top of fairing bracket.
3. Route main harness conduit terminating in the main to interconnect harness [2] and front wheel speed sensor [167] connectors in through opening on left side of fairing bracket, but first connect front wheel speed sensor connector if ABS equipped.
4. Route main harness conduit, terminating in the radio antenna cable [51], twist grip sensor jumper harness [204], ignition switch [33], and main to interconnect harness connectors, [1] and [15], in through opening on right side of fairing bracket.
5. See Figure 2-153. Draw wire harnesses and conduit out tunnel of fairing bracket and pull as far forward as possible. Tightly wrap clean shop towels around the main harness conduit, radio antenna cable, twist grip sensor jumper harness conduit, and handlebar switch conduit, and secure with masking tape.
6. Install right side instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.

Inner Fairing

1. Place protective material on top of front fender to protect paint from scratches or other damage. Rest inner fairing (with attached radio bracket and interconnect harness) on front fender.
2. See Figure 2-154. Place inner fairing over four fairing bracket studs while feeding end of harness bundle through opening beneath radio. Verify that sides of inner fairing are positioned outboard of both fairing supports (on engine guards).
3. Install four locknuts to secure radio bracket and inner fairing to fairing bracket studs. Tighten locknuts to 96-144 **in-lbs** (10.9-16.3 Nm).
4. See Figure 2-153. Draw the harness bundle as far forward as possible, resting the end of the bundle on the front fender.
5. Find branch of interconnect harness terminating in ambient temperature sensor connector, 3-place Multilock. Feed connector and conduit from front of inner fairing into tunnel and then out through opening on left side of fairing bracket. Install connector on ambient temperature sensor anchored in hole on left side of steering head.
6. Find branch of interconnect harness terminating in odometer reset switch and speedometer, tachometer, indicator

lights and instrument nacelle switch connectors. Feed connectors and conduit from front of inner fairing through tunnel of fairing bracket and then out through opening at top of fairing bracket to instrument nacelle.

7. See Figure 2-149. Connect instrument nacelle switch connector [105A/B], 12-place Multilock, to interconnect harness.
8. Returning to front of inner fairing, remove shop towels and masking tape from around the harness bundle. Separate main harness conduit, radio antenna cable, twist grip sensor jumper harness conduit, and handlebar switch conduit.
9. Find branch of main harness terminating in ignition switch connector. Feed connector and conduit from front of inner fairing through tunnel of fairing bracket and then out through opening at top of fairing bracket to instrument nacelle.
10. Connect ignition switch connector [33], 3-place Packard, at front of ignition switch housing.
11. Connect interconnect harness ground socket terminal to spade contact at front of upper fork bracket (left side).
12. See Figure 2-152. Connect handlebar switches to interconnect harness. Proceed as follows:
 a. Left handlebar switch connector [24], 16-place Molex (gray); T-stud on left side of radio bracket.
 b. Right handlebar switch connector [22], 12-place Molex (black); T-stud on left side of radio bracket.
13. Connect twist grip sensor jumper harness connector [204], 6-place Molex (black), to main harness.
14. Connect radio antenna cable connector [51] at back of radio (left side).
15. Connect main harness to interconnect harness as follows:
 a. Main to interconnect harness connector [1], 16-place Molex (black); below radio (right side).
 b. Main to interconnect harness connector [2], 12-place Molex (gray); below radio (right side).
 c. Main to interconnect harness connector [15], 4-place Packard (black); below radio (right side).



1. **Ignition switch**
2. **Twist grip sensor jumper harness**
3. **Left and right handlebar switches**
4. **Main harness**

Figure 2-155. Route Main Harness and Conduit Thru Fairing Bracket

16. Orient connectors. Install two **new** cable straps outboard of radio bracket hooks to secure wire bundles and conduit to convoluted tubing of interconnect harness. Cut any excess cable strap material.

NOTE

To avoid chafing wires of interconnect harness, verify that trim strips are installed inboard of hooks on radio bracket.

17. Install outer fairing. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
18. Install left side of instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.
19. Install bezel. See 2.42 INSTRUMENT BEZEL: FLTR.

GLOVE BOX DOOR AND HINGE: FLTR 2.45

GLOVE BOX DOOR AND HINGE

Removal

1. Remove the outer fairing. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
2. To access glove box door fasteners, pull out screw cap cover below hinge.
3. Holding locknuts at front of inner fairing, loosen hinge screws.
4. Hold glove box door closed as hinge screws are completely removed. If not held closed, door will pop open as spring loaded hinge is released and door may be dropped to the floor.
5. If hinge replacement is necessary, remove plastic barrels to release hinge from door.

Installation

1. Place spring inside hinge inserting spring pin into closest hole. With coil and one spring pin positioned inside hinge, second spring pin is outside.
2. Place hinge into position capturing free end of external spring pin between ribs molded into glove box door.
3. Install plastic barrels to hold hinge in door. Slot in barrel prevents interference with spring pin installed between ribs of door. Push barrels in until tight.

NOTE

*Install **new** glove box door bumpers in inner fairing if damaged or missing. Insert tail of rubber bumper into hole, and moving to front of inner fairing, pull anchor through hole.*

4. Place glove box door into position against inner fairing. Holding locknuts (with flat washers) at front of inner fairing, tighten hinge screws.
5. To conceal glove door fasteners, snap screw cap cover into place below hinge.
6. Install the outer fairing. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.

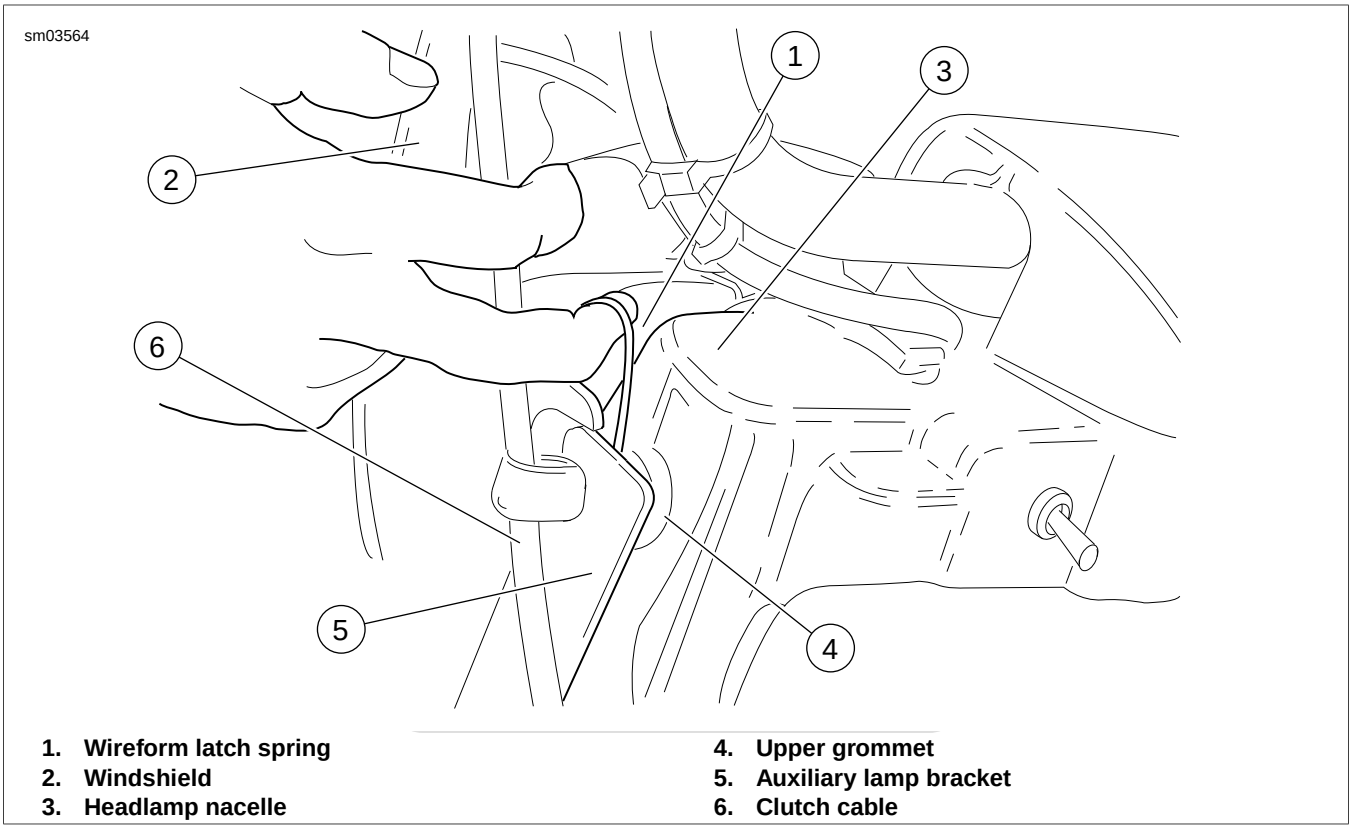
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

WINDSHIELD: FLHR/C 2.46

WINDSHIELD

Removal

1. See Figure 2-156. Raise the wireform latch springs on both sides of the windshield.
2. Gently pull on the top of the windshield until the upper notches on the windshield brackets are free of the upper grommets.
3. Carefully raise the windshield until the lower notches are free of the lower grommets.
4. Remove windshield from motorcycle.



1. **Wireform latch spring**
2. **Windshield**
3. **Headlamp nacelle**
4. **Upper grommet**
5. **Auxiliary lamp bracket**
6. **Clutch cable**

Figure 2-156. Windshield (FLHR/C)

Installation

NOTE

To avoid scratching headlamp nacelle or auxiliary lamp bracket, be sure that all four notches on the windshield brackets are firmly seated on a rubber grommet.

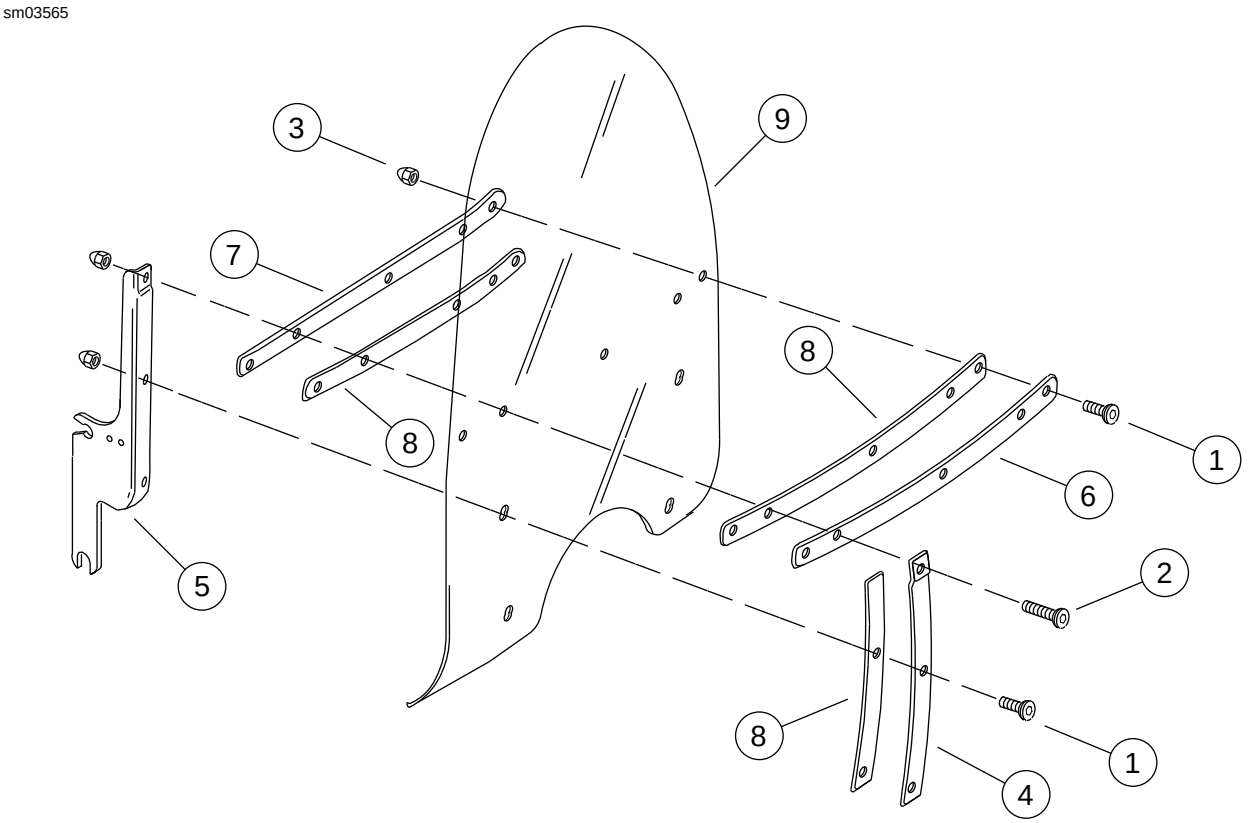
1. Carefully insert the windshield brackets between the headlamp nacelle and the auxiliary lamp bracket. Lower the windshield into position until the lower notches on the windshield brackets are seated on the lower grommets.
2. See Figure 2-156. Gently push the top of the windshield toward the rear until the upper notches fully engage the upper grommets.
3. Push down on the wireform latch springs, so that they overhang the rubber grommets. If some adjustment is necessary, loosen the retaining screws and rotate the latch springs into the proper position.

WINDSHIELD WINDOW

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN

Removal

1. Remove windshield. See 2.46 WINDSHIELD: FLHR/C.
2. Place windshield front side up on clean padded surface.
3. See Figure 2-157. Holding acorn nuts on rear side, remove three T27 TORX screws from one of two vertical braces to release mounting bracket. Repeat step to remove second mounting bracket.
4. Remove three remaining screws from horizontal brace.



1. **T27 TORX screws, short (7)**
2. **T27 TORX screws, long (2)**
3. **Acorn nuts (9)**
4. **Vertical brace (right side)**
5. **Mounting bracket (right side)**
6. **Horizontal brace (front)**
7. **Horizontal brace (rear)**
8. **Two-sided adhesive strip**
9. **Windshield**

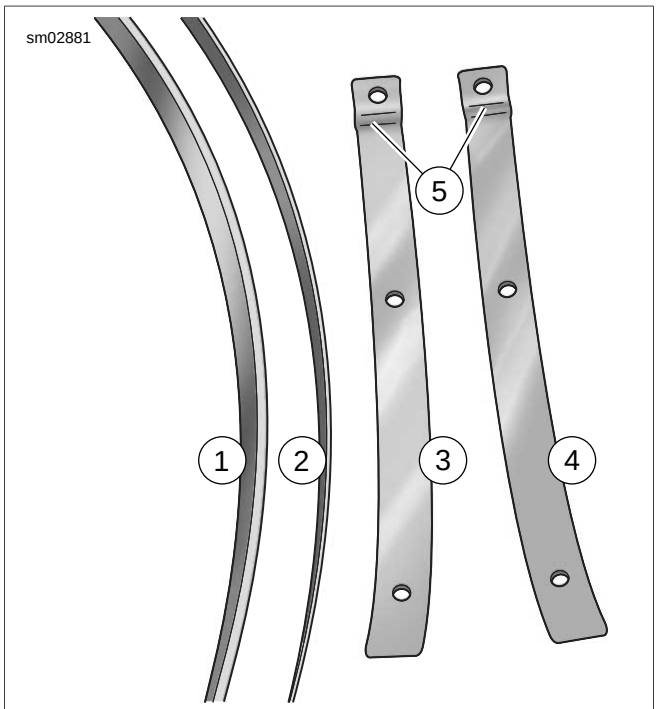
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Figure 2-157. Windshield Assembly

5. Carefully pry two vertical and one horizontal brace from front of windshield, and then turn windshield over and carefully pry horizontal brace from rear. Discard windshield.
6. Remove adhesive strip from braces. Proceed as follows:
 a. Liberally apply 3M general purpose adhesive remover (Part No. 051135) and allow to soak.
 b. Carefully apply heat with ROBINAIR HEAT GUN (Part No. HD-25070).
 c. Peel adhesive strip from braces.
 d. Remove any remaining adhesive with 3M general Purpose adhesive remover (Part No. 051135).

Installation

1. Obtain four **new** two-sided adhesive strips, one for each brace.
2. Remove paper backing from one side of each adhesive strip and apply to respective brace.
3. Place **new** windshield front side down on clean padded surface.
4. See Figure 2-158. Locate the two vertical braces with the step on one end and set these aside for later use. Now pick the thicker of the two horizontal braces that remain.
5. Remove paper backing from adhesive strip on thicker horizontal brace, and aligning holes in brace with horizontal set of holes in windshield, press brace into position.
6. Turn windshield over, so that the front side is up.
7. Remove paper backing from adhesive strip and fix thinner horizontal brace to windshield. Properly positioned, holes in brace must be aligned with horizontal set of holes in windshield and edges must be even with the edges of the thicker brace already installed.
8. Locate the two long T27 TORX screws and set these aside for later use.



1. **Horizontal brace - thick (rear)**
2. **Horizontal brace - thin (front)**
3. **Vertical brace (right side)**
4. **Vertical brace (left side)**
5. **Stepped ends**

Figure 2-158. Windshield Braces

9. Apply one drop of Loctite Medium Strength Threadlocker 243 (blue) to threads of three short screws. Slide screws through the middle and outer holes of the horizontal braces. Loosely install acorn nuts on rear side.
10. See Figure 2-158. Remove paper backing from adhesive strip on vertical brace. With the stepped end overlapping the installed horizontal brace (and the slight bend on the opposite end angled outward), align holes in brace with vertical set of holes in windshield, and press into position.
11. Position mounting bracket on rear side of windshield with the wireform facing inboard. Align three holes in mounting bracket with those in vertical brace.
12. Apply one drop of Loctite Medium Strength Threadlocker 243 (blue) to threads of two short screws and one long screw. Slide screws through holes in vertical brace and mounting bracket, the longer screw at the stepped end where the vertical brace overlaps the horizontal brace. Loosely install acorn nuts on rear side.
13. Repeat previous steps to install second vertical brace and mounting bracket.
14. See Figure 2-159. Holding acorn nuts on rear side, alternately tighten nine T27 TORX screws to 20-25 **in-lbs** (2.3-2.8 Nm).
15. Install windshield. See 2.46 WINDSHIELD: FLHR/C.

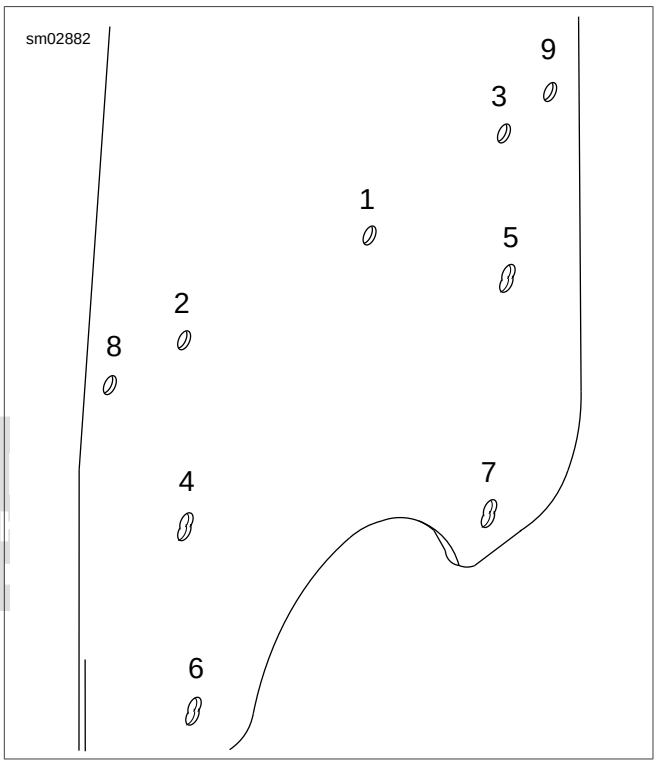
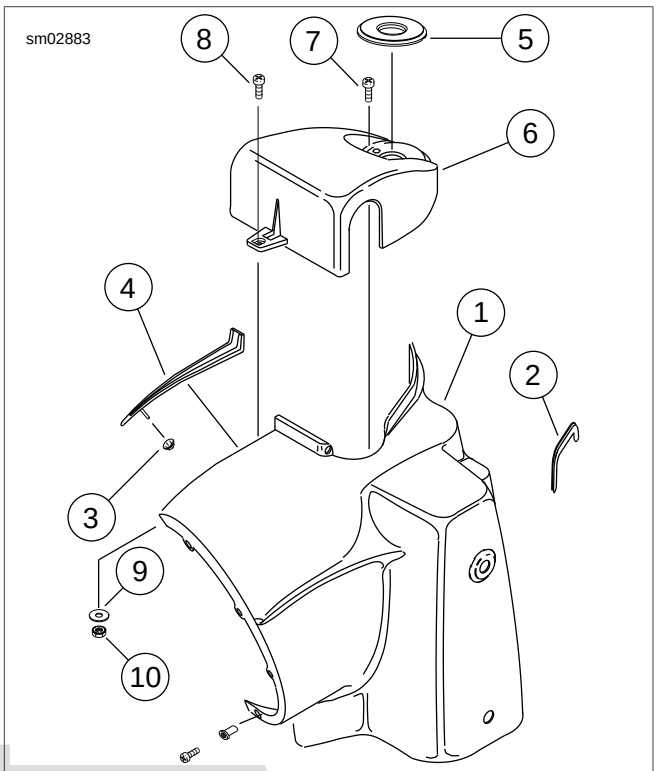


Figure 2-159. Windshield Torque Sequence

HEADLAMP NACELLE: FLHR/C 2.47

REMOVAL

1. Remove windshield. See 2.46 WINDSHIELD: FLHR/C.
2. Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door.
3. Remove the seven Phillips screws to free the headlamp housing from the headlamp nacelle.
4. Remove headlamp connector [38] at back of headlamp bulb. Remove the headlamp housing assembly from the motorcycle.
5. See Figure 2-160. Reaching inside the headlamp nacelle, remove the flange nut to release the chrome strip at the top of the nacelle.
6. Carefully pry off the fork lock plate at the rear of the handlebar clamp shroud. Remove two Phillips screws beneath the lock plate.
7. Loosen the Phillips screw from tab at the front of the handlebar clamp shroud (but do not remove Keps nut and flat washer).
8. Remove the two acorn nuts from the left side fork bracket studs. Remove acorn nuts from the right side fork bracket studs.
9. Cover the front fender with suitable material to protect the fender paint. Remove the auxiliary lamp bracket from the left and right side fork bracket studs and carefully set on front fender.
10. Remove the grommets (and clutch cable clamp) from the left and right side fork bracket studs.
11. See Figure 2-161. Raise the handlebar clamp shroud, and after separating the halves of the headlamp nacelle slightly, slide the shroud forward running the shaft of the Phillips screw down the gap.
12. See Figure 2-162. Reaching inside the headlamp nacelle, disconnect accessory switch connector [67] and auxiliary lamp switch connector [109].
13. Carefully separate the halves of the headlamp nacelle and remove from motorcycle.



1. **Headlamp nacelle (left side**
2. **Trim strip**
3. **Flange nut**
4. **Chrome strip**
5. **Fork lock plate**
6. **Handlebar clamp shroud**
7. **Phillips screw (2)**
8. **Phillips screw**
9. **Flat washer**
10. **Keps nut**

Figure 2-160. Headlamp Nacelle Assembly

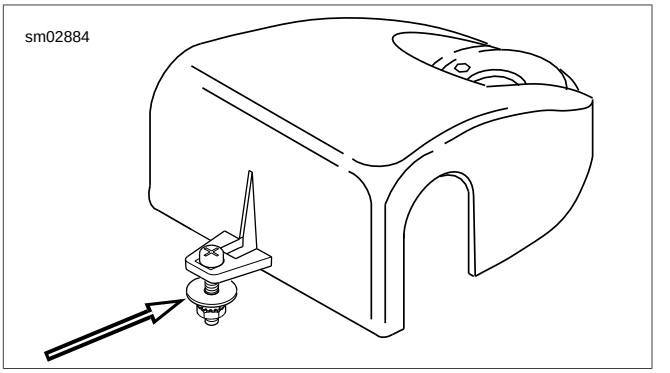


Figure 2-161. Handlebar Clamp Shroud and Screw Assembly

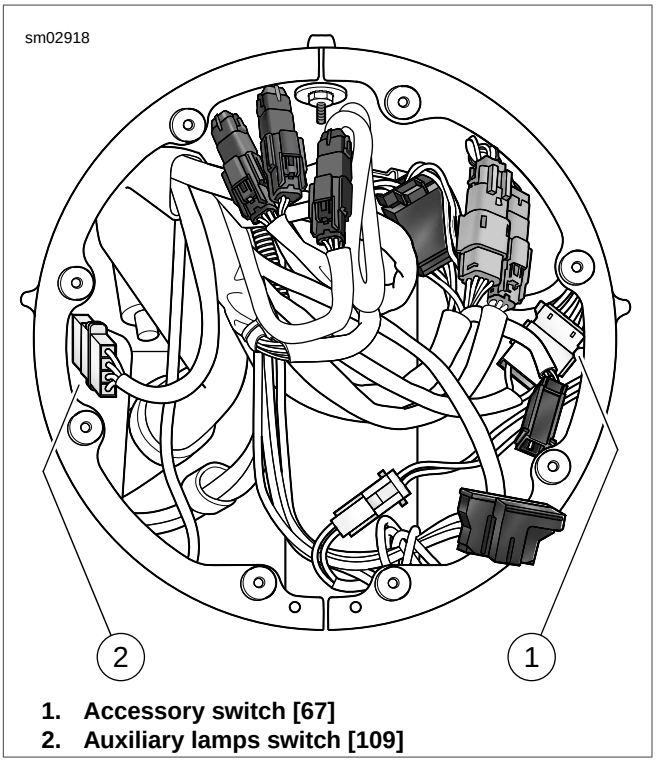
INSTALLATION

1. Fit halves of the headlamp nacelle together engaging the holes in the nacelle with the left and right side fork bracket studs.
2. See Figure 2-162. Reaching inside the headlamp nacelle, connect accessory switch connector [67] and auxiliary lamp switch connector [109].
3. See Figure 2-161. If disassembled, install Phillips screw, flat washer and Keps nut on the handlebar clamp shroud.
4. Part the halves of the headlamp nacelle slightly. With the flat washer on the inboard side of the nacelle, slide the shroud rearward running the shaft of the Phillips screw down the gap. Position the shroud over the flange at the top of the nacelle.
5. Mate the halves of the headlamp nacelle and tighten the Phillips screw to 10-20 **in-lbs** (1.1-2.3 Nm).
6. Install two Phillips screws to secure handlebar clamp shroud to the fork lock mechanism. Alternately tighten screws to 10-20 **in-lbs** (1.1-2.3 Nm). Install fork lock plate.

NOTE

To avoid possible damage to the brake hose and/or handlebar switch wires, verify that trim strips are installed on inside edges of the headlamp nacelle. Cutting or severe chafing of the brake hose and/or handlebar switch wires could cause loss of function while riding.

7. Verify that trim strips are installed on inside edges of headlamp nacelle. Install **new** trim strips if cracked, damaged or missing.
8. Inserting the weld stud on the chrome strip into the hole at the top of the headlamp nacelle, reach inside the nacelle to install flange nut. Tighten flange nut to 15-20 **in-lbs** (1.7-2.3 Nm).
9. Install the grommets on the left and right side fork studs.
10. Slide the auxiliary lamp bracket onto the left and right side fork bracket studs. Verify that the four grommets are in place on the inboard side of the auxiliary lamp brackets.



1. Accessory switch [67]
2. Auxiliary lamps switch [109]

Figure 2-162. Headlamp Nacelle (FLHRC)

11. Install the acorn nuts on the fork bracket studs and tighten to 72-108 **in-lbs** (8.1-12.2 Nm). Be sure to capture the clutch cable clamp on the upper left stud before installing the acorn nut.
12. Install headlamp connector [38] at back of headlamp bulb.
13. Align holes in headlamp housing with wellnuts in headlamp nacelle (headlamp door bracket at bottom). Install the seven Phillips screws and alternately tighten to 9-18 **in-lbs** (1.0-2.0 Nm).
14. Fit the square-shaped portion of the headlamp door spring into the slot at the top of the headlamp housing and then snap the headlamp door (chrome ring) into place. Install Phillips screw at the bottom of the headlamp door and tighten to 9-18 **in-lbs** (1.0-2.0 Nm).
15. Install windshield. See 2.46 WINDSHIELD: FLHR/C.

FRONT FENDER 2.48

REMOVAL

NOTE

Start procedure at step 4 if fender tip lamp is absent.

1. **FLHR:**
 a. Remove screw at bottom of headlamp door (chrome ring). Remove headlamp door.
 b. Remove seven screws to free headlamp housing from headlamp nacelle.
 c. Remove headlamp connector [38] at back of headlamp bulb.
 d. Remove headlamp housing assembly from motorcycle.
 e. See Figure 2-163. Disconnect front fender tip lamp jumper harness connector [32], 2-place Multilock.
2. **FLHT/C/U:** See Figure 2-164. Reaching in below the fairing cap on the left side of the steering head, disconnect front fender tip lamp jumper harness connector [32], 2-place Multilock.

NOTE

Remove outer fairing only if necessary. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

3. Draw socket housing down to fender area.
4. Remove front wheel. See 2.4 FRONT WHEEL.
5. Bend tabs on lockplates away from heads of four front fender mount screws. Remove screws and lockplates. Remove fender from motorcycle.

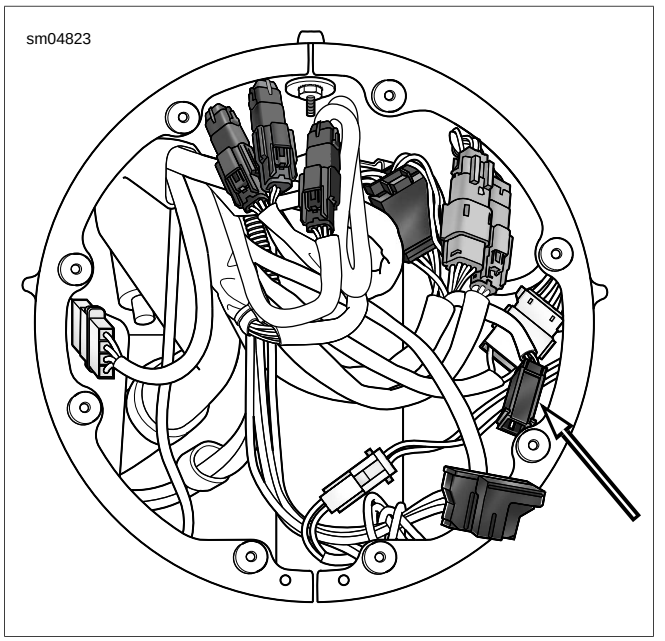


Figure 2-163. Front Fender Tip Lamp Jumper Harness Connector (FLHR/C)

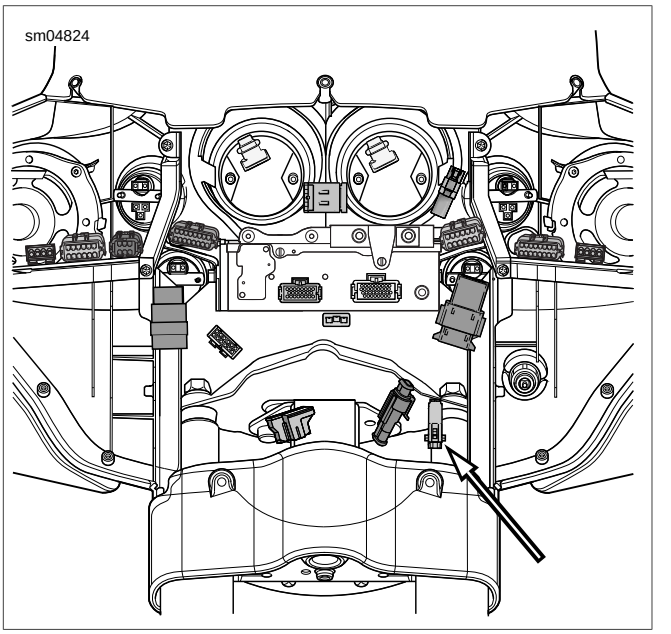


Figure 2-164. Front Fender Tip Lamp Jumper Harness Connector (FLHT/C/U)

INSTALLATION

1. Install lockplates on four front fender mount screws. Align holes in fender with those in fork sliders and start screws.
2. Alternately tighten screws to 16-20 ft-lbs (22-27 Nm). Bend tabs on lockplates against flats on screw heads.

NOTE

Skip the next step if fender tip lamp is absent.

3. Route socket housing upward behind chrome skirt (FLHT/C/U) or through bottom of headlamp nacelle (FLHR) to area beneath upper fork bracket. Connect front fender tip lamp jumper harness connector [32].

NOTE

To connect front fender tip lamp with the outer fairing installed (FLHT/C/U models), reach in below the fairing cap on the left side of the steering head.

4. Install front wheel. See 2.4 FRONT WHEEL.
5. **FLHR:**
 a. Install headlamp connector [38] at back of headlamp bulb.
 b. Align holes in headlamp housing with wellnuts in headlamp nacelle (headlamp door bracket at bottom).
 c. Install seven screws and alternately tighten to 9-18 **in-lbs** (1.0-2.0 Nm).
 d. Install headlamp door (chrome ring) and door screw. Tighten screw to 9-18 **in-lbs** (1.0-2.0 Nm).
6. **FLHT/C/U:** Install outer fairing, if removed. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

REAR FENDER 2.49

REMOVAL

1. **FLHX:** Remove rear fascia and rear fascia lamp. See 2.50 REAR FASCIA: FLHX.
2. Remove seat. See 2.28 SEAT.
3. See Figure 2-165. Disconnect rear lighting connector. Release connector from fender.
4. Remove left and right side covers.
5. Disconnect air lines from shock absorbers.
6. See Figure 2-166. Remove saddlebag support fastener (4) from each side.
7. Remove fastener (10), seat strap (9) and saddlebag bracket (8) from each side.
8. Remove fastener (11) on each side. Remove covers (1).

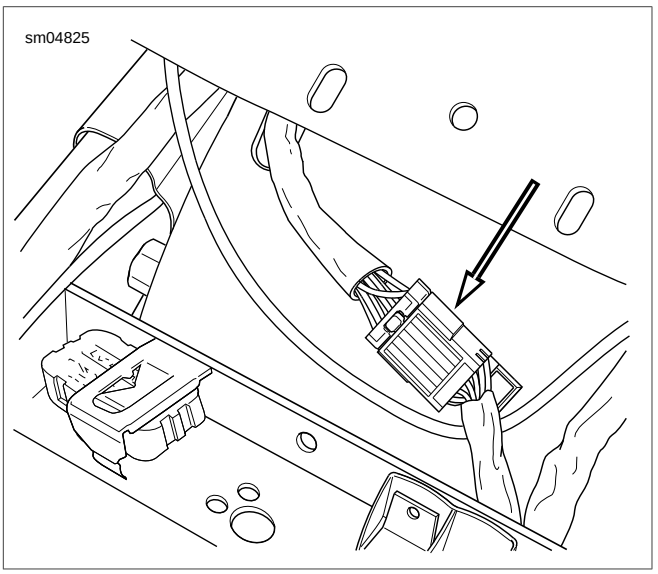
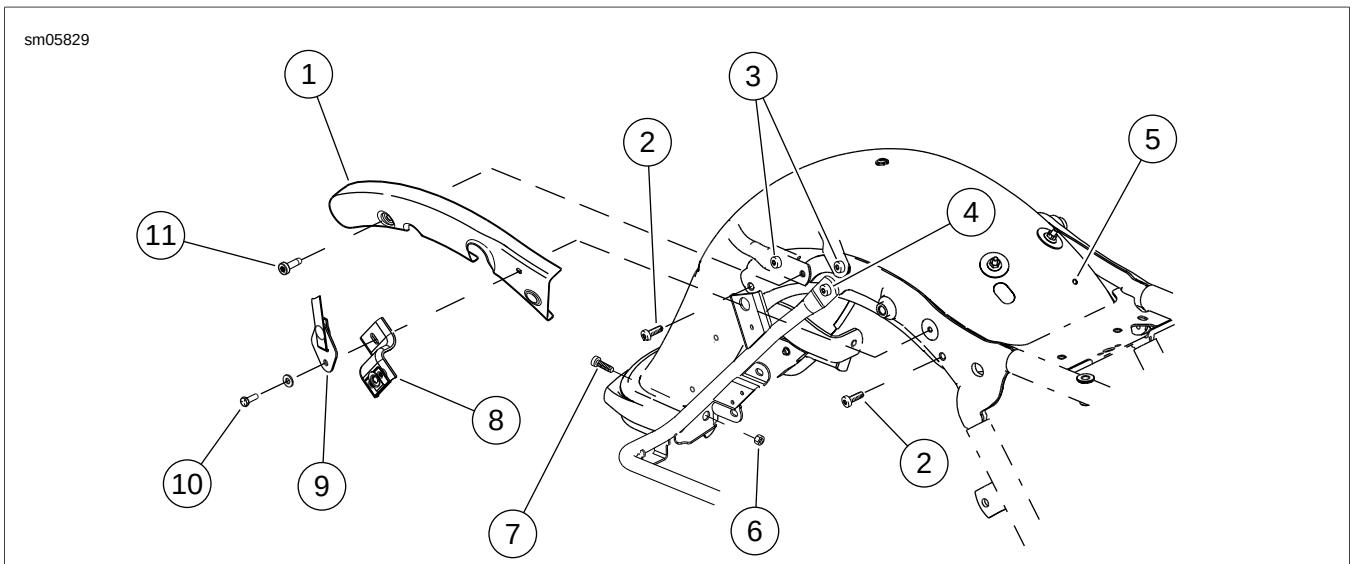


Figure 2-165. Rear Fender Lights Connector



1. **Cover (2)**
2. **Fastener, fender support to fender support (2)**
3. **Fastener, luggage rack to fender support (4)**
4. **Fastener, saddlebag support to fender support**
5. **Tail light connector anchor location**
6. **Nut, fender to saddlebag support (2)**
7. **Fastener, fender to saddlebag support (2)**
8. **Forward saddlebag bracket (2)**
9. **Seat strap**
10. **Cover fastener, front (2)**
11. **Cover fastener, rear (2)**

Figure 2-166. Rear Fender

9. See Figure 2-166. Remove fasteners (7) and flange nuts (6) to release fender support bracket from saddlebag support.
10. If equipped with a luggage rack or Tour-Pak, back out screws (3) 2-3 turns.
11. Remove fender mounting screws (2) from both sides. Be aware that rear fender will drop when screws are removed.
12. See Figure 2-167. Carefully roll the fender back and out of the frame.

INSTALLATION

1. See Figure 2-167. Carefully roll the fender into position.
2. See Figure 2-166. Install four fasteners (2) and tighten to 15-20 ft-lbs (20-27 Nm).

3. Tighten four luggage rack fasteners (3) to 15-20 ft-lbs (20-27 Nm).

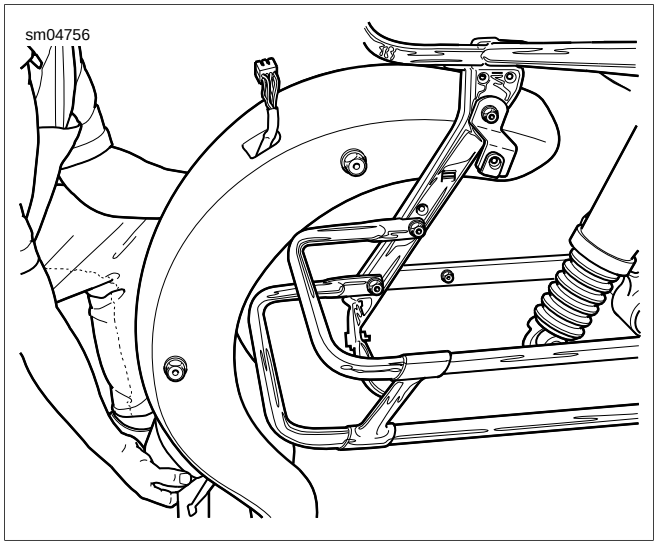


Figure 2-167. Carefully Roll Out Rear Fender

4. See Figure 2-166. Install rear fender support-to-saddlebag support fastener (7) and nut (6). Tighten to 15-20 ft-lbs (20-27 Nm).
5. Install cover (1) on each side and start fastener (11). Verify all electrical harnesses are above the cover flange and not pinched.
6. Install forward cover fastener (10) along with flat washer, seat strap (9) and saddlebag bracket (8) on each side but do not tighten at this time.
7. Install saddlebag support fastener (4) on each side. The air suspension fitting bracket is also retained by this fastener on the left side. Tighten fasteners (4) to 15-20 ft-lbs (20-27 Nm).
8. Tighten cover fasteners (11) to 15-20 ft-lbs (20-27 Nm).
9. Connect air suspension lines to shock absorbers.
10. See Figure 2-165. Connect rear fender lights connector and secure anchor in rear fender hole.
11. Install side covers.
12. Install seat. See 2.28 SEAT.
13. Install saddlebags. The front bracket (8) may need to be rotated to align with attachment stud. Once saddlebags are secured, tighten fasteners (10) to 12-15 ft-lbs (16.3-20.3 Nm).
14. **FLHX:** Install rear fascia lamp and rear fascia. See 2.50 REAR FASCIA: FLHX.

REAR FENDER LIGHTS CONDUIT

Removal

1. Remove rear fender.
2. Remove rear fender lights harness. See 7.14 TAIL LAMP, Rear Fender Lights Harness.
3. Carefully cut adhesive conduit and remove wire harness.
4. Remove terminals from socket housing of rear fender lights connector. See A.1 AMP MULTILOCK CONNECTORS.

Installation

1. Draw rear fender lights harness through **new** adhesive conduit until progress is halted by installed cable strap. If absent, install **new** cable strap as follows:
 a. Adjust conduit so that end is 0.25 in. (6.35 mm) or less from wire end of connector [7B].
 b. Install cable strap 8.75 in. (222.25 mm) from mating end of connector as shown in Figure 2-168. Cut any excess cable strap material.

NOTE

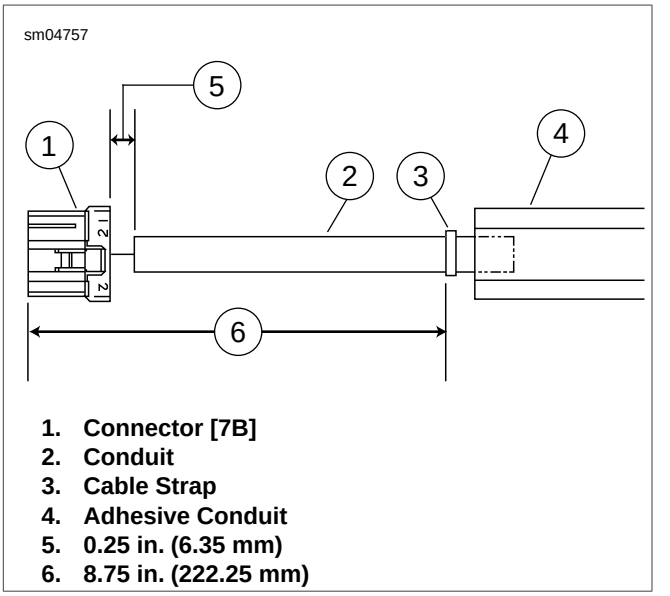
Proper placement of the cable strap prevents rearward movement of the rear fender lights harness.

2. Install terminals into socket housing of rear fender lights connector [94]. See A.1 AMP MULTILOCK CONNECTORS. Refer to Table 2-20 for proper wire location.

Table 2-20. Rear Fender Lights [94]

WIRE COLOR	CHAMBER NUMBER	WIRE COLOR	CHAMBER NUMBER
Orange/White	1	Red/Yellow	4
Brown	2	Violet	5
Blue	3	Black	6

3. Install rear fender lights harness. See 7.14 TAIL LAMP, Rear Fender Lights Harness.
4. Install rear fender.



1. **Connector [7B]**
2. **Conduit**
3. **Cable Strap**
4. **Adhesive Conduit**
5. **0.25 in. (6.35 mm)**
6. **8.75 in. (222.25 mm)**

Figure 2-168. Install Cable Strap on Conduit

REAR FASCIA: FLHX 2.50

REMOVAL

1. Remove saddlebags. See 2.29 SADDLEBAGS.
2. See Figure 2-169. Remove six flange nuts (1).
3. Loosen set screw and remove radio antenna mast from left side of motorcycle.
4. Gently open adhesive conduit at split line to release rear fascia lamp wires.
5. Spread top of fascia (2) to release from top studs at sides of fender and then pull bottom in a downward direction to release fascia from fender.
6. Remove two screws to release lamp assembly from fascia.

INSTALLATION

1. Install lamp assembly to fascia. Tighten screws to 18-22 **in-lbs** (2.0-2.5 Nm).
2. Insert flange at top of fascia between flap and fender. Notch in flange engages locator bump on flap when fascia is fully installed. Spread top of fascia to engage top studs at sides of fender.
3. See Figure 2-169. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of each stud. Install flange nuts (1) and tighten to 30-45 **in-lbs** (3.4-5.1 Nm).
4. Gently open adhesive conduit at split line and insert rear fascia lamp wires.
5. Install radio antenna mast and tighten set screw.
6. Install saddlebags. See 2.29 SADDLEBAGS.

STUD PLATE

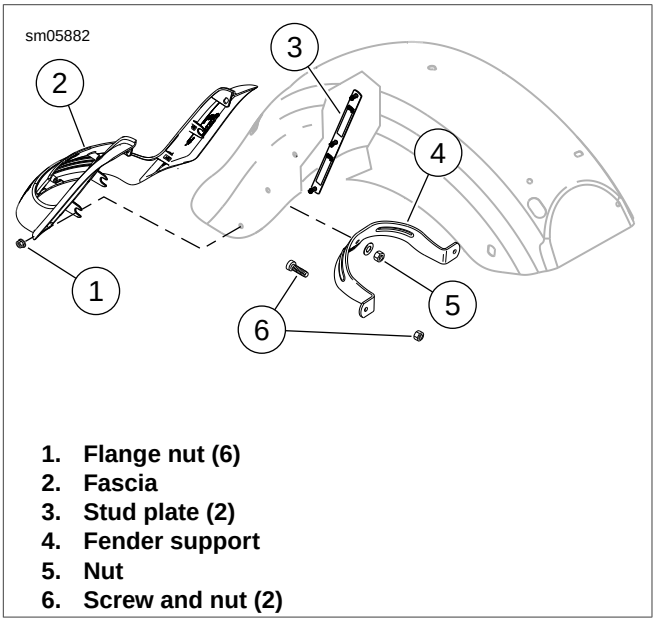
Removal

1. Remove rear wheel as necessary to gain access to fender well. See 2.5 REAR WHEEL.
2. See Figure 2-169. Remove flange nuts (1).
3. Remove screw and nut (6) securing fender support (5) to saddlebag support on both sides. Remove nut (5) and flat washer. Remove support (4).

NOTE

Stud plates installed in production use adhesive strips as an assembly aid. Beginning at the edges, carefully work stud plate free using a small putty knife or gasket scraper.

4. Carefully pry stud plate (3) away from rear fender.



1. **Flange nut (6)**
2. **Fascia**
3. **Stud plate (2)**
4. **Fender support**
5. **Nut**
6. **Screw and nut (2)**

Figure 2-169. Rear Fascia

Installation

1. Install **new** stud plate (3).
2. See Figure 2-169. Install flange nuts on studs and alternately tighten to 30-45 **in-lbs** (3.4-5.1 Nm).
3. Install fender support (4). Tighten screw and nut (6) to 15-20 ft-lbs (20.3-27.1 Nm). Tighten nut (5) to 45-85 **in-lbs** (5.1-9.6 Nm).
4. Install rear wheel. See 2.5 REAR WHEEL.

REAR FASCIA LAMP

Removal

1. Remove rear fascia. See 2.50 REAR FASCIA: FLHX, Removal.
2. Cut cable straps to release fascia lamp wires and radio antenna cable from saddlebag support and rear frame.
3. Disconnect rear fascia lamp connector located inboard of upper frame tube.

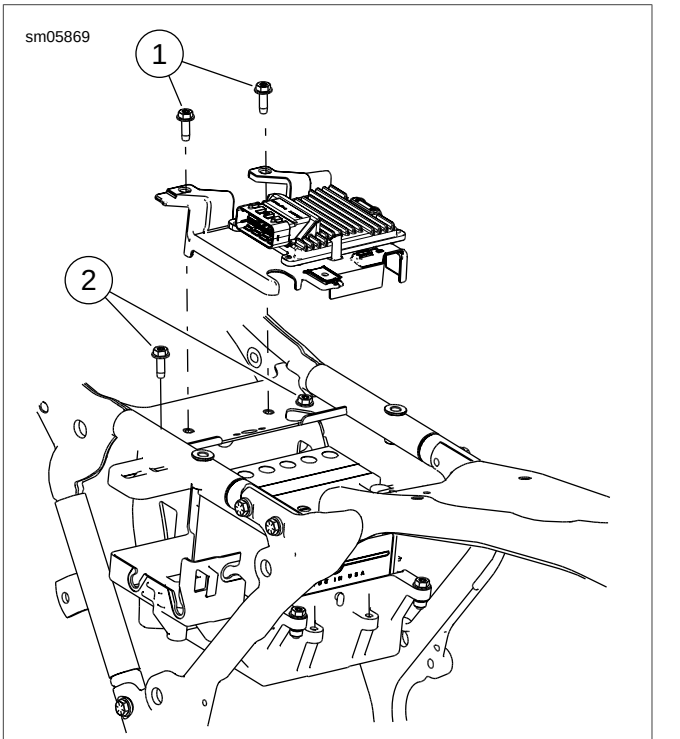
Installation

1. Route rear fascia lamp wires forward along saddlebag support and rear frame to inboard side of upper frame tube.
2. Mate fascia lamp connector.
3. Install **new** cable straps to secure rear fascia lamp wires and radio antenna cable to rear frame and saddlebag support.
4. Install rear fascia. See 2.50 REAR FASCIA: FLHX, Installation.

REAR FRAME

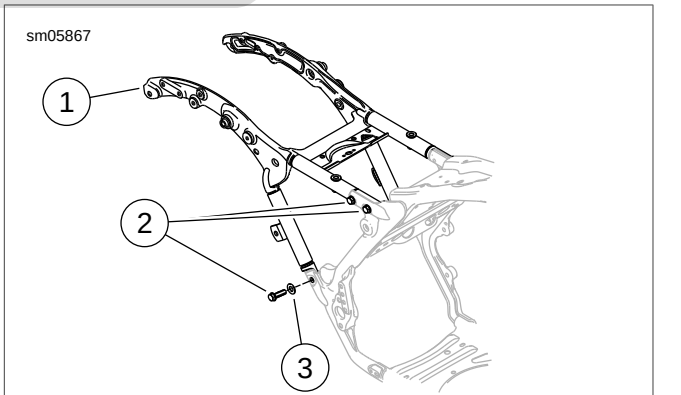
Removal

1. Support the motorcycle with a scissors jack.
2. Remove the seat.
3. See Figure 2-170. Remove top caddy and move caddy aside. See 7.7 ELECTRICAL CADDIES.
4. Remove battery. See 1.17 BATTERY MAINTENANCE.
5. **FLHTC/U:** Remove Tour-Pak. See 2.31 TOUR-PAK.
6. Cut cable straps securing harnesses to each side of rear frame and luggage rack and move harnesses aside. Take note of cable strap locations for reassembly.
7. Remove rear fender. See 2.49 REAR FENDER.
8. Remove saddlebag supports. See 2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail.
9. Remove shock absorbers. See 2.23 REAR SHOCK ABSORBERS.
10. Remove luggage rack if equipped. See 2.31 TOUR-PAK, Luggage Rack/Tour-Pak Support.
11. See Figure 2-170. Remove two upper battery tray fasteners (2).
12. Remove fastener that secures left-side electrical caddy to rear frame.
13. See Figure 2-171. Remove six fasteners (2) and washers (3) securing the rear frame (1).
14. Remove rear frame.



1. **Top caddy fasteners**
2. **Rear battery tray fasteners**

Figure 2-170. Upper Caddy Fasteners



1. **Rear frame**
2. **Fasteners (6)**
3. **Hardened washer (6)**

Figure 2-171. Subframe

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

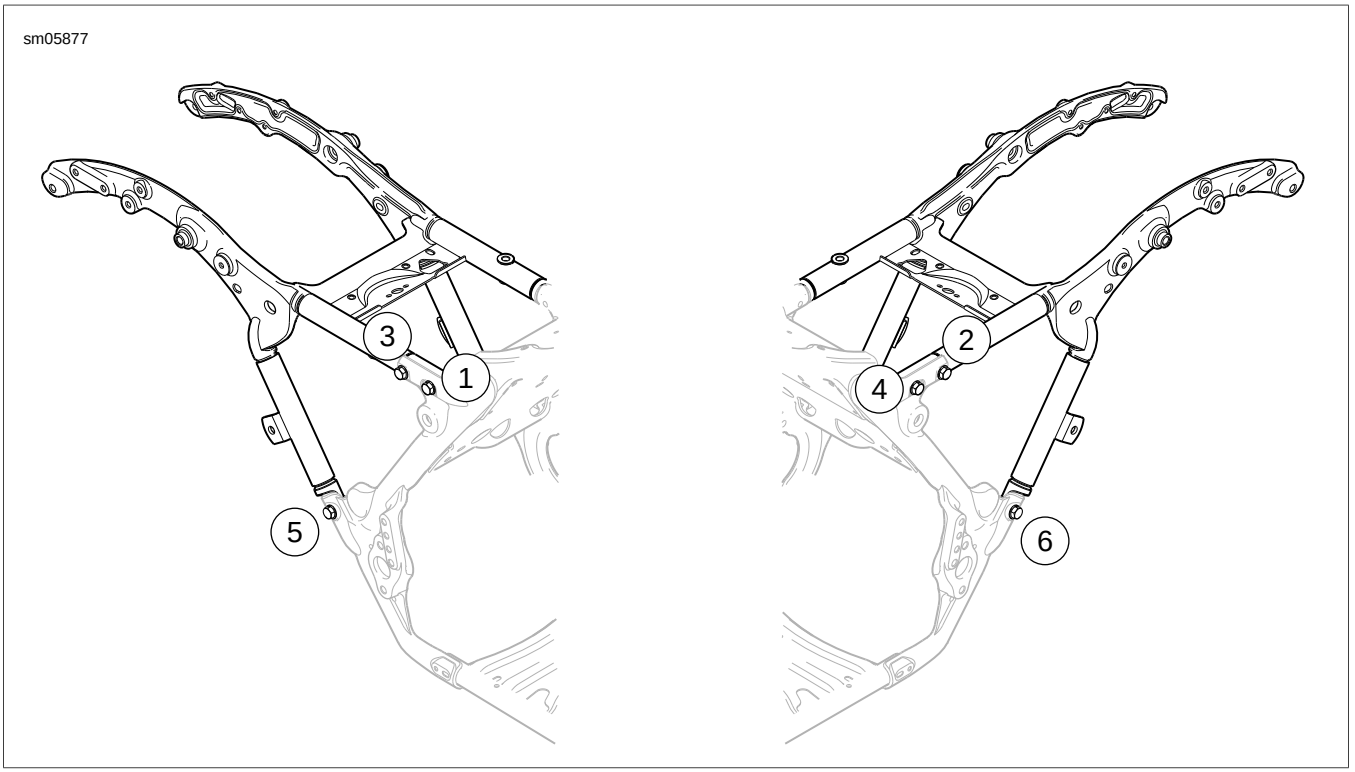


Figure 2-172. Rear Frame Torque Sequence

Installation

1. See Figure 2-171. Fit the rear frame to the main frame and start two lower fasteners (2) with hardened washers (3). Install four remaining upper fasteners and hardened washers.
2. See Figure 2-172. Tighten rear frame fasteners in sequence shown to 40-50 ft-lbs (54.2-67.8 Nm).
3. Secure left-side electrical caddy to rear frame and tighten fastener to 72-96 **in-lbs** (8.1-10.8 Nm).
4. See Figure 2-170. Secure upper battery tray to rear frame. Tighten fasteners (2) to 72-96 **in-lbs** (8.1-10.8 Nm).
5. Install luggage rack if equipped. See 2.31 TOUR-PAK, Luggage Rack/Tour-Pak Support.
6. Install shock absorbers. See 2.23 REAR SHOCK ABSORBERS.
7. Install rear fender. See 2.49 REAR FENDER.
8. Install saddlebag supports. See 2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail.
9. **FLHTC/U:** Install Tour-Pak. See 2.31 TOUR-PAK.
10. Secure harnesses to each side of rear frame and luggage rack with cable straps. Position straps as noted during disassembly.
11. Install saddlebags.
12. Install battery. See 1.17 BATTERY MAINTENANCE.
13. See Figure 2-170. Install top caddy and tighten fasteners (1) to 72-96 **in-lbs** (8.1-10.8 Nm).

WARNING

After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

14. Install the seat.

Thread Repair

NOTES

- *Never re-tap the threaded holes in the rear frame to repair damaged threads. Always use the following procedure to provide repair.*
- *If more than one threaded hole is damaged on a given side, or if a thread repair has previously been done, the rear frame must be replaced. Never repair more than one hole per side.*

1. Remove the damaged fastener.
2. Drill out damaged threads and install the appropriate size Heli-Coil thread insert.
3. Install **new** fastener with hardened washer and tighten to the proper torque.

FOOTBOARDS AND FOOTRESTS 2.52

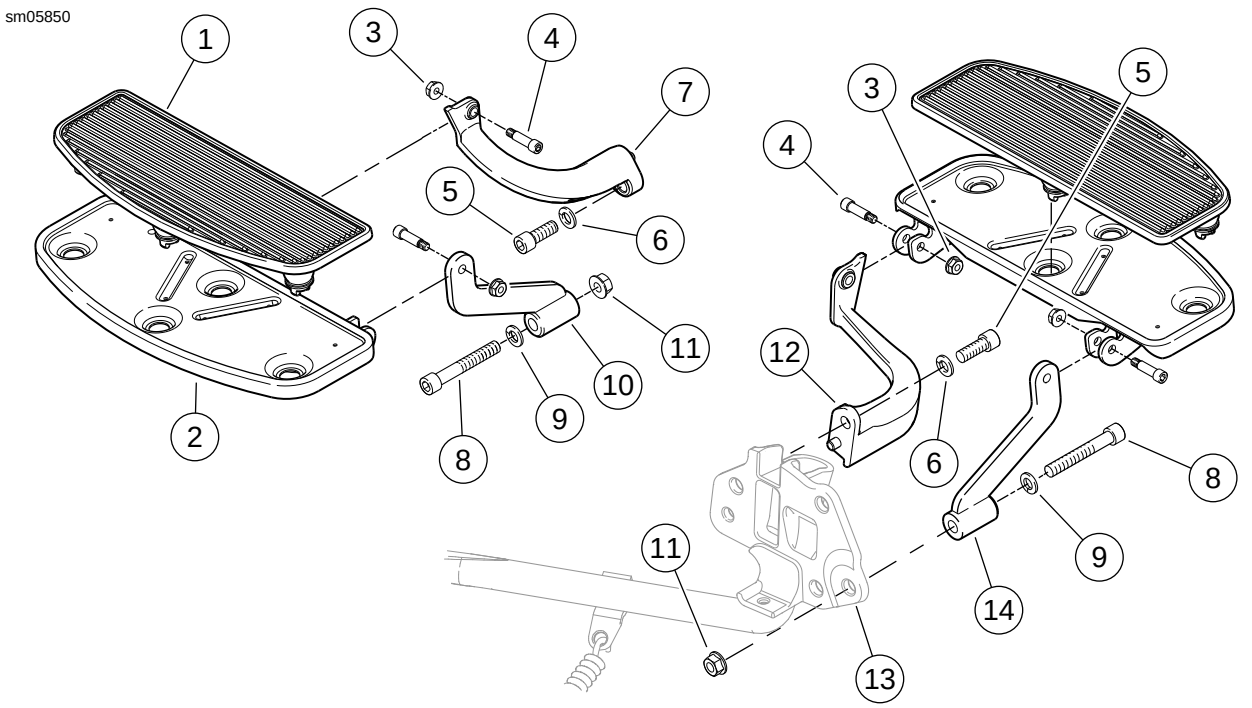
RIDER FOOTBOARDS

Removal

1. If removing left side footboard, raise motorcycle on center stand so that weight is not resting on jiffy stand.
2. See Figure 2-173. Remove socket head screw (5) and lockwasher (6).
3. Remove socket head screw (8), lockwasher (9) and flange nut (11).
4. Remove footboard and bracket assembly from motorcycle.

Installation

1. See Figure 2-173. Install footboard and bracket assembly and secure with socket head screws (5, 8), lockwashers (6, 9), and flange nut (11).
2. Tighten socket head screws to 36-42 ft-lbs (48.8-57.0 Nm).



1. **Rubber pad**
2. **Footboard**
3. **Pivot screw nut (2)**
4. **Pivot screw (2)**
5. **Socket head screw, short**
6. **Lockwasher**
7. **Right rear bracket**
8. **Socket head screw, long**
9. **Lockwasher**
10. **Right forward bracket**
11. **Flange nut**
12. **Left rear bracket**
13. **Jiffy stand bracket**
14. **Left forward bracket**

Figure 2-173. Rider Footboards (Typical) (Quantities shown are for each footboard)

Disassembly

NOTE

If only replacing the rubber pad, refer to step 1 below and then see steps 3-4 under ASSEMBLY.

1. Tilt footboard upward. From bottom of footboard, use a large flat blade screwdriver to push four rubber anchors on pad up through holes in footboard.
2. See Figure 2-173. Remove nuts (3) and pivot screws (4) from underside of footboard.
3. Remove footboard from brackets.

Assembly

1. Place footboard into position between brackets and install pivot screws (4) so that the nuts (3) will be on the inboard side.

NOTE

The bottom of FLHX footboards are stamped L(eft) or R(ight) to verify proper installation.

2. Install nuts (3) onto pivot screws and tighten to 60-80 **in-lbs** (6.8-9.0 Nm).

3. Moisten four rubber anchors on bottom of **new** pad (1) with soapy water.
4. Place pad into position on footboard. From bottom of footboard, use pliers to pull rubber anchors through holes in footboard.

PASSENGER FOOTBOARD

Removal

See Figure 2-174. Remove socket head screw (7), lockwasher (8) and footboard/bracket assembly from rear swingarm bracket.

Installation

NOTE

Passenger footboards can be adjusted to one of three positions. To move footboards to a new position, remove plastic plugs from holes in rear swingarm bracket as necessary.

1. Locate pin on footboard bracket into hole in rear swingarm bracket.
2. See Figure 2-174. Install socket head screw (7) and lockwasher (8). Tighten screw to 36-42 ft-lbs (48.8-56.9 Nm).

Disassembly

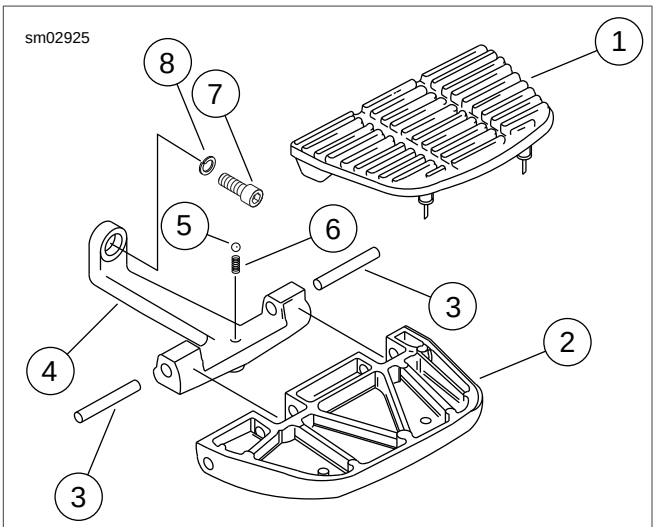
NOTE

If only replacing the rubber pad, refer to step 1 below and then see steps 3-4 under ASSEMBLY.

1. See Figure 2-174. Tilt footboard upward. From bottom of footboard, use a small flat blade screwdriver to push rubber beads on pad up through holes in footboard. Remove pad.
2. Using a brass drift and rubber mallet, tap two pivot pins (3) toward center of footboard and remove.
3. Remove footboard from footboard bracket.
4. Remove steel ball (5) and spring (6) from hole in footboard bracket.

Assembly

1. See Figure 2-174. Place spring (6) into hole in footboard bracket. Place ball (5) on top of spring.
2. Place footboard into position on bracket and install pivot pins (3) from the outboard side. Using a brass drift and rubber mallet, tap pins until centered in lugs of bracket.



1. **Rubber pad**
2. **Footboard**
3. **Pivot pin (2)**
4. **Footboard bracket**
5. **Steel ball**
6. **Spring**
7. **Socket screw**
8. **Lockwasher**

Figure 2-174. Passenger Footboard (All Models Except FLHX)

3. Moisten rubber beads on **new** pad with soapy water. Place pad into position on footboard. From bottom of footboard, use needle nose pliers to pull rubber beads down through holes in footboard.
4. Engage nubs on inboard corners of pad with holes in footboard.

PASSENGER FOOTREST: FLHX

Removal

See Figure 2-175. Remove socket head screw (9) and lockwasher (10) to remove footrest bracket from frame.

Installation

1. Locate pin on footrest bracket into hole in frame.

NOTE

Passenger footrests can be adjusted to one of three positions. To move footrests to a new position, remove plastic plugs from holes in frame as necessary.

2. See Figure 2-175. Install socket head screw (9) and lockwasher (10). Tighten screw to 36-42 ft-lbs (48.8-56.9 Nm).

Disassembly

NOTE

If only replacing the rubber pad, refer to step 1 below and then see steps 7-9 under ASSEMBLY.

1. See Figure 2-175. Remove socket head screw (1). Remove rubber pad (2) from footrest.
2. Remove footrest (3) from footrest mount.
3. Remove retaining ring (4). Remove pivot pin (5).

4. Remove footrest mount (6) and wave spring (7).

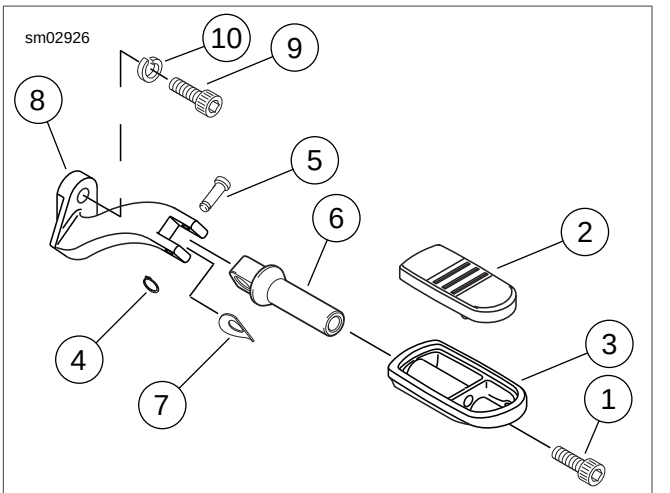
Assembly

1. See Figure 2-175. Align hole in wave spring with lower hole in footrest bracket. Be sure that the concave side is down and the flat edge is against the inboard side of the footrest bracket.
2. Holding wave spring in place, install footrest mount in bracket with the rounded side of the pivot end up.
3. Install pivot pin.

NOTE

Verify operation of footrest mount before installing retaining ring. The ease with which the footrest mount pivots is based on the curvature of the wave spring. Flattening the wave spring allows the footrest mount to move more easily, while increasing the curvature makes movement more difficult.

4. Install **new** retaining ring.
5. Slide footrest onto footrest mount.
6. Place rubber pad into footrest.
7. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of socket head screw and install.
8. Rotate footrest so that the rubber pad is topside and tighten socket head screw to 15-20 ft-lbs (20-27 Nm).



1. **Socket screw**
2. **Rubber pad**
3. **Footrest**
4. **Retaining ring**
5. **Pivot pin**
6. **Footrest mount**
7. **Wave spring**
8. **Footrest bracket**
9. **Socket screw**
10. **Lockwasher**

Figure 2-175. Passenger Footrest (FLHX)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

JIFFY STAND 2.53

GENERAL

WARNING

The jiffy stand locks when placed in the full forward (down) position with vehicle weight on it. If the jiffy stand is not in the full forward (down) position with vehicle weight on it, the vehicle can fall over which could result in death or serious injury. (00006a)

WARNING

Always park motorcycle on a level, firm surface. An unbalanced motorcycle can fall over, which could result in death or serious injury. (00039a)

REMOVAL

WARNING

Block vehicle under frame such that vehicle will not fall when jiffy stand is removed. Failure to properly block vehicle could result in death or serious injury. (00462b)

1. Block motorcycle under frame, so that motorcycle is securely upright and level. Jiffy stand should be able to move through its full range of travel without the weight of the motorcycle resting on it.
2. See Figure 2-178. Move jiffy stand to the full forward (down) position. Remove hex bolt (4), lockwasher (3), flat washer (2) and leg stop (5).
3. Swing jiffy stand forward beyond the normal down position and remove end of spring (9) from jiffy stand. Remove leg (8) from bracket. Remove other end of spring from frame weldment.
4. Inspect components for worn or damaged parts. Replace parts as necessary.

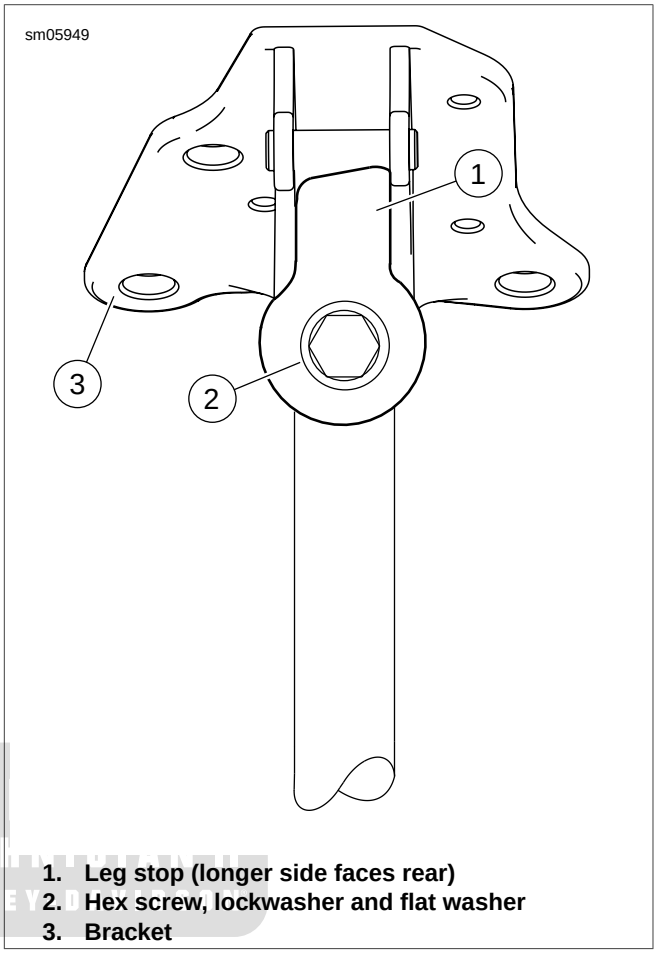
INSTALLATION

1. Apply anti-seize lubricant to area of leg that rotates within the bracket.

NOTE

See Figure 2-177. Verify that end of spring enters hole from front of leg weldment. If end of spring enters hole from rear of weldment, spring coil will rub on leg when exercised.

2. Install end of spring into hole in frame weldment. Insert leg up through bracket. Swing jiffy stand forward beyond the normal down position and install other end of spring into hole in leg weldment.
3. See Figure 2-176. Holding leg at the normal forward (down) position, install stop (1) over threaded end with the stamped side down. Verify that the longer side of the stop faces the rear of the motorcycle. Install flat washer, lockwasher and hex screw. Tighten hex screw to 15-20 ft-lbs (20.3-27.1 Nm).



1. **Leg stop (longer side faces rear)**
2. **Hex screw, lockwasher and flat washer**
3. **Bracket**

Figure 2-176. Leg Stop Orientation in Full Forward (Down) Position

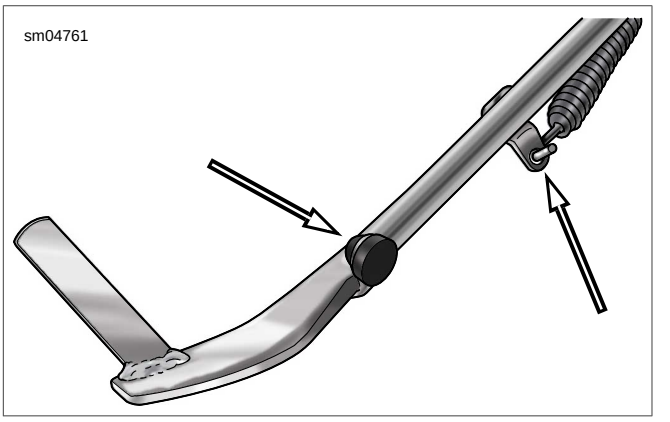


Figure 2-177. Rubber Stop and Spring Orientation

WARNING

If leg stop is incorrectly installed, excessive wear can allow vehicle to fall when rested on jiffy stand, which could result in death or serious injury. (00479b)

4. Extend and retract jiffy stand several times to verify proper operation. Jiffy stand should swing freely to the fully extended and fully retracted positions.
5. Move jiffy stand to the full forward (down) position. Carefully remove support blocking from beneath motorcycle frame and rest motorcycle on jiffy stand.

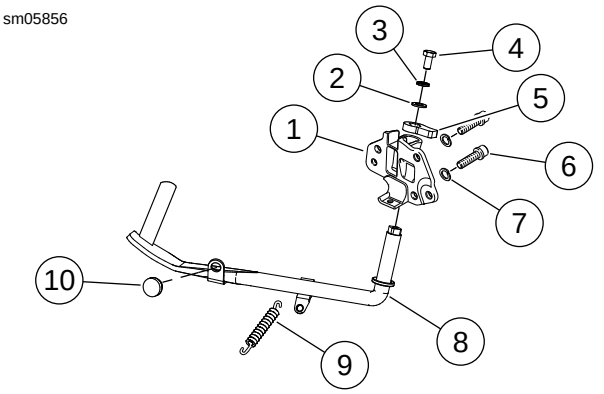
NOTE

See Figure 2-177. Verify that rubber stop is installed in hole of jiffy stand weldment to prevent damage to the painted finish.

JIFFY STAND BRACKET

Removal

1. Support motorcycle with scissors jack.
2. Remove left rider footboard and support brackets. See 2.52 FOOTBOARDS AND FOOTRESTS.
3. See Figure 2-178. Remove jiffy stand leg (8).
4. Remove two fasteners (6) and lockwashers (7) to release jiffy stand bracket from frame weldment.



1. **Bracket**
2. **Flat washer**
3. **Lockwasher**
4. **Bolt**
5. **Stop**
6. **Fastener (2)**
7. **Lockwasher (2)**
8. **Leg**
9. **Spring**
10. **Rubber stop**

Figure 2-178. Jiffy Stand Assembly

Installation

1. See Figure 2-178. Install two fasteners (6) and lockwashers (7) to secure front of bracket (1) to frame weldment.
2. Temporarily install footboard rear fastener to align rear of jiffy stand bracket but do not tighten.
3. Tighten front fasteners (6) to 36-42 ft-lbs (48.8-57.0 Nm).
4. Install footrest. See 2.52 FOOTBOARDS AND FOOTRESTS.
5. Install jiffy stand leg.

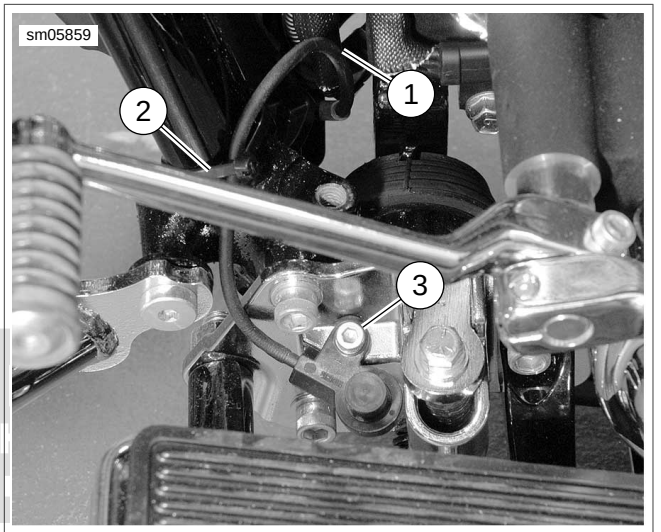
JIFFY STAND INTERLOCK SENSOR

Removal

NOTE

See Figure 2-179. The sensor connector (1) is located below the voltage regulator.

1. Push anchor on sensor connector from hole in front frame cross member. Disconnect connector.
2. See Figure 2-179. Cut cable strap (2) to release cable.
3. Move jiffy stand to full forward (down) position.
4. Remove fastener (3) and pull sensor from jiffy stand bracket.



1. **Connector location**
2. **Cable strap**
3. **Sensor fastener**

Figure 2-179. Jiffy Stand Interlock Sensor

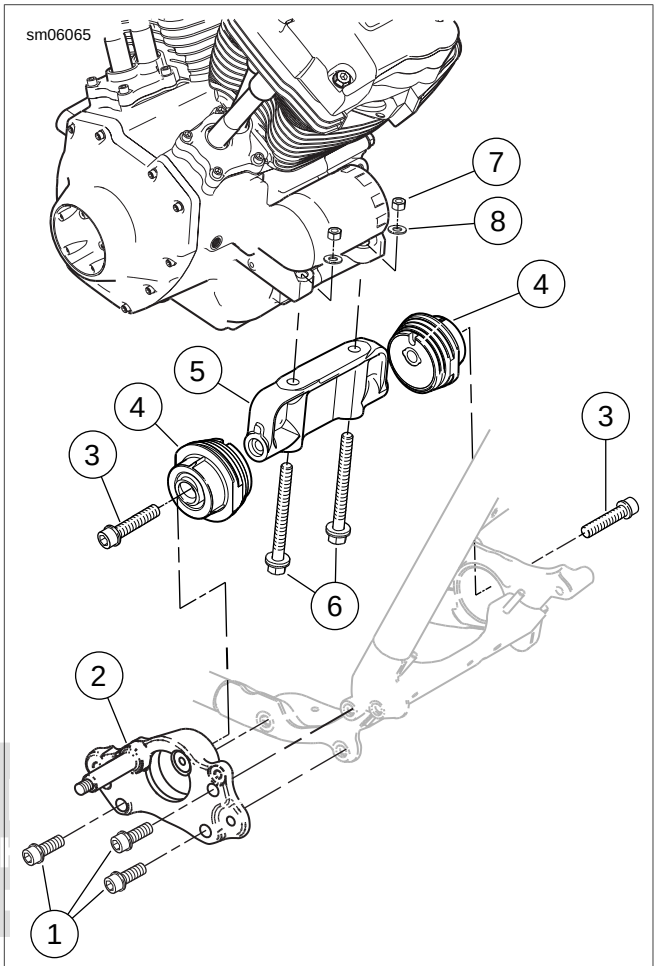
Installation

1. Move jiffy stand to full forward (down) position.
2. See Figure 2-179. Install sensor into bore of jiffy stand bracket.
3. If reusing fastener (3), apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads before installation. Install fastener (3) and tighten to 96-120 **in-lbs** (10.8-13.6 Nm).
4. Route connector and cable over top of frame weldment, staying rear of front frame down tube, and to area below voltage regulator (1).
5. Connect jiffy stand interlock sensor connector and push anchor into hole in front frame cross member.
6. Install **new** cable strap (2) to capture cable. Cut any excess cable strap material.

FRONT ENGINE MOUNT 2.54

REMOVAL

1. Remove right lower fairing, if present. See 2.36 LOWER FAIRING AND ENGINE GUARD.
2. Remove right side rider footboard. See 2.52 FOOTBOARDS AND FOOTRESTS.
3. Place a jack under the oil pan and use a block of wood between the jack and the oil pan to distribute pressure across the length of the casting. Raise the jack until firm contact is made with the bottom of the oil pan.
4. Remove rear brake pedal from master cylinder and engine mount end cap. See 2.16 REAR BRAKE MASTER CYLINDER.
5. Remove rear master cylinder from engine mount end cap.
6. See Figure 2-180. Loosen, but do not remove, front engine mount fasteners (3).
7. Remove engine mounts.
 a. Remove nuts (7), washers (8) and engine mount bracket fasteners (6).
 b. Remove end cap fasteners (1). and end cap (2).
 c. Remove engine mount bracket (5) with attached engine mounts (4).
8. Remove front engine mount fasteners and engine mounts from engine mount bracket.



1. **End cap fastener**
2. **End cap**
3. **Front engine mount fastener**
4. **Engine mount**
5. **Engine mount bracket**
6. **Engine mount bracket fasteners**
7. **Nut**
8. **Washer**

Figure 2-180. Front Engine Mount

INSTALLATION

NOTES

- *See Figure 2-180. Tapered end of engine mounts (4) face engine mounting bracket (5).*
- *Notches on engine mounts fit over tabs on engine mount bracket.*

1. Install engine mounts to engine mount bracket. Install front engine mount fasteners finger tight.
2. Install left side engine mount into frame weldment on left side of motorcycle.
3. Install end cap (2) over right engine mount.
4. Install end cap fasteners finger tight.

5. Install engine mount bracket fasteners (6) through bottom of engine mounting bracket.
6. Apply Loctite Medium Strength Threadlocker 243 (blue) to threads of nuts (7). Install washers (8) and nuts. Tighten engine mount bracket fasteners to 36-40 ft-lbs (48.8-54.2 Nm).
7. Tighten end cap fasteners to 42-48 ft-lbs (56.9-65.0 Nm).
8. Tighten front engine mount fasteners to 40-50 ft-lbs (54.2-67.8 Nm).
9. Install master cylinder to engine mount end cap. Install rear brake pedal. See 2.16 REAR BRAKE MASTER CYLINDER.
10. Install right side rider footboard. See 2.52 FOOTBOARDS AND FOOTRESTS.

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NOTES

FASTENER TORQUE VALUES 3.1

FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

FASTENER	TORQUE VALUE		NOTES
Breather assembly bolts	90-120 **in-lbs**	10.2-13.6 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly
Cam chain tensioner fasteners	100-120 **in-lbs**	11.3-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam cover screws	125-155 **in-lbs**	14.1-17.5 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Crankcase bolts, final	15-19 ft-lbs	20.3-25.8 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Crankcase bolts, initial	10 ft-lbs	13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Crankcase pipe plugs	120-144 **in-lbs**	13.6-16.3 Nm	3.28 CRANKCASE, Pipe Plug and Oil Fittings
Crankcase to front engine mounting bracket nuts	36-40 ft-lbs	48.8-54.2 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Crank sprocket bolt, final torque	24 ft-lbs	32.5 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Crossover pipe hanger bracket	84-132 **in-lbs**	9.5-14.9 Nm	3.30 OIL PAN, Installation
Cylinder head bolts, final	15-17 ft-lbs	20.3-23.0 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head/See special method to tighten
Cylinder head bolts, final	15-17 ft-lbs	20.3-23.1 Nm	3.24 CYLINDER, Inspection
Cylinder head bolts, initial	120-144 **in-lbs**	13.5-16.2 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head/See special method to tighten
Cylinder head bolts, initial	120-144 **in-lbs**	13.6-16.3 Nm	3.24 CYLINDER, Inspection
Cylinder stud	10-20 ft-lbs	3.6-27.1 Nm	3.28 CRANKCASE, Cylinder Studs
Engine oil drain plug	14-21 ft-lbs	19.0-28.5 Nm	3.30 OIL PAN, Installation/Clean plug before installation
Lifter cover screws	90-120 **in-lbs**	10.2-13.6 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Push Rods, Lifters and Covers
Oil pan fasteners	84-132 **in-lbs**	9.5-14.9 Nm	3.30 OIL PAN, Installation/Torque sequence
Oil pan tapered plug	18-22 ft-lbs	24.4-29.8 Nm	3.30 OIL PAN, Installation/Apply Loctite Pipe Sealant With Teflon 565 (P/N 99818-97)
Oil pump screws, initial torque	40-45 **in-lbs**	4.5-5.1 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Piston jet screws	25-35 **in-lbs**	2.8-3.9 Nm	3.28 CRANKCASE, Right Crankcase Half
Primary cam sprocket flange bolts, final torque	34 ft-lbs	46.1 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Primary cam sprocket flange bolts, initial torque	15 ft-lbs	20.3 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Primary cam sprocket flange bolts, initial torque	15 ft-lbs	20.3 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover

FASTENER	TORQUE VALUE		NOTES
Rocker arm support plate bolts	18-22 ft-lbs	24.4-29.8 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate
Rocker cover bolts	15-18 ft-lbs	20.3-24.4 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly
Rocker housing bolts	120-168 **in-lbs**	13.6-19.0 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head
Secondary cam chain tensioner fastener	100-120 **in-lbs**	11.3-13.6 Nm	3.26 CAM SUPPORT PLATE AND COVER, Camshafts
Top engine mounting bracket stabilizer link to frame weldment bolt	30-35 ft-lbs	41-48 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Top engine mounting bracket stabilizer link to frame weldment bolt	30-35 ft-lbs	41-48 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Top engine mounting bracket to front cylinder head bolts	30-35 ft-lbs	41-48 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Top engine mounting bracket to front cylinder head bolts	30-35 ft-lbs	41-48 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	3.30 OIL PAN, Installation/Clean plug before installation
Transmission to crankcase bolts	15 ft-lbs	20.3 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission to crankcase bolts	34-39 ft-lbs	46.1-52.9 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

SPECIFICATIONS 3.2

SPECIFICATIONS

Table 3-1. Engine: 2009 Touring Models

ITEM	SPECIFICATION	
Number of cylinders	2	
Type	4-cycle, 45 degree V-Type, air cooled	
Compression ratio	9.2-1	
Bore	3.750 in.	95.25 mm
Stroke	4.380 in.	111.25 mm
Displacement	96.00 cu. in.	1584.00 cu. cm
Torque (North America)	92.60 ft-lbs @ 3500 RPM	125.57 Nm @ 3500 RPM
Torque (International)	90.20 ft-lbs @ 3400 RPM	122.31 Nm @ 3400 RPM
Torque (Japan)	86.90 ft-lbs @ 2500 RPM	117.84 Nm @ 2500 RPM

Table 3-2. Oil Pump Specifications

OIL PUMP	DATA
Type	Twin geroter, dual scavenge, crank mounted and driven, internal oil pump, dry sump
Pressure	30-38 PSI (207-262 kN/m^2) at 2000 RPM and normal operating temperature of 230° F (110° C)
Filtration	5 micron media, filtered between pump and engine

Table 3-3. Rocker Arms Specifications

ROCKER ARMS	IN.	MM
Shaft fit in bushing (loose)	0.0005-0.0020	0.013-0.051
End clearance	0.003-0.013	0.08-0.33
Bushing fit in rocker arm (tight)	0.002-0.004	0.051-0.102

Table 3-4. Rocker Arm Shaft Specifications

ROCKER ARM SHAFTS	IN.	MM
Shaft fit in rocker arm support plate (loose)	0.0007-0.0022	0.018-0.056

Table 3-5. Hydraulic Lifter Specifications

HYDRAULIC LIFTERS	IN.	MM
Fit in crankcase (loose)	0.0008-0.0020	0.02-0.05

Table 3-6. Cylinder Head Specifications

CYLINDER HEAD	IN.	MM
Valve guide in head (tight)	0.0022-0.0033	0.051-0.084
Valve seat in head (tight)	0.003-0.0045	0.076-0.114
Valve stem protrusion (min)	2.022	51.36
Head gasket surface (flatness)	0-0.006	0-0.152

Table 3-7. Valve Specifications

VALVES	IN.	MM
Exhaust: fit in guide	0.001-0.003	0.0254-0.0762
Intake: fit in guide	0.001-0.003	0.0254-0.0762
Seat Width	0.040-0.062	1.02-1.58
Stem protrusion from cylinder head boss	2.012-2.032	51.10-51.61

Table 3-8. Valve Springs Specifications

VALVE SPRINGS	IN.	MM
Closed	135 lbs @ 1.850 in.	61.2 kg @ 47.0 mm
Open	312 lbs @ 1.300 in.	141.5 kg @ 33.0 mm
Free length	2.325 in.	59.1 mm

Table 3-9. Piston

PISTON		REPLACE IF WEAR EXCEEDS	
		IN.	MM
Fit in cylinder (loose)		0.0014-0.0025	0.036-0.064
Piston pin fit (loose)		0.0002-0.0005	0.00-0.013
Ring end gap	Top compression	0.010-0.020	0.254-0.508
	2nd compression	0.014-0.024	0.356-0.610
	Oil control ring	0.010-0.050	0.254-1.27
Ring side clearance	Top compression	0.0012-0.0037	0.030-0.094
	2nd compression	0.0012-0.0037	0.030-0.094
	Oil control rails	0.0031-0.0091	0.079-0.231

Table 3-10. Connecting Rod Specifications

CONNECTING ROD	IN.	MM
Piston pin fit (loose)	0.0007-0.0012	0.018-0.030
Side play between flywheels	0.005-0.015	0.13-0.38
Connecting rod to crankpin (loose)	0.0004-0.0017	0.0102-0.0432

Table 3-11. Flywheel Specifications

FLYWHEELS	IN.	MM
Runout (shaft measured in case)	0.000-0.010	0.0-0.254
Runout (measured in truing stand)	0.000-0.004	0.0-0.102
End play	0.003-0.013	0.076-0.330

Table 3-12. Crankshaft/Sprocket Shaft Bearing Specifications

CRANKSHAFT/SPROCKET SHAFT BEARINGS	IN.	MM
Roller bearing fit (loose)	0.0002-0.0015	0.005-0.038
Bearing fit in crankcase (tight)	0.0038-0.0054	0.097-0.137
Bearing inner race on crankshaft (tight)	0.0004-0.0014	0.010-0.036

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SERVICE WEAR LIMITS 3.3

GENERAL

Wear limits are given here as a guideline for measuring used engine components. Replace components when they exceed values listed here.

Table 3-13. Rocker Arm/Rocker Arm Shaft

ROCKER ARM/ROCKER ARM SHAFT	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Shaft fit in bushing (loose)	0.0035	0.089
End clearance	0.025	0.635
Shaft fit in rocker arm support (loose)	0.0035	0.089

Table 3-14. Hydraulic Lifter

HYDRAULIC LIFTER	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Fit in crankcase	0.003	0.076
Roller fit	0.0015	0.038
Roller end clearance	0.022	0.559

Table 3-15. Cam Support Plate

CAM SUPPORT PLATE	REPLACE IF	
	IN.	MM
Cam chain tensioner shoe	More than 0.090	More than 2.29
	1/2 thickness of shoe	
Crankshaft bushing maximum ID	More than 0.8545	More than 21.704
Camshaft bore	1.1023	27.998

Table 3-16. Cylinder Head

CYLINDER HEAD	REPLACE IF	
	IN.	MM
Valve guide in head (tight)	Less than 0.002	Less than 0.051
Valve seat in head (tight)	Less than 0.002	Less than 0.051
Valve stem protrusion	More than 2.069	More than 52.553
Head warpage	More than 0.006	More than 0.152

Table 3-17. Cylinder

CYLINDER	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Taper	0.002	0.051
Out of round	0.002	0.051
Warpage of gasket surfaces: top	0.006	0.152
Warpage of gasket or O-ring surfaces: base	0.004	0.102

Table 3-18. Cylinder Bore

CYLINDER BORE	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Standard	3.752	95.301
0.005 in. oversize	3.757	95.428
0.010 in. oversize	3.762	95.555

Table 3-19. Piston

PISTON		REPLACE IF WEAR EXCEEDS	
		IN.	MM
Fit in cylinder (loose)		0.003	0.076
Piston pin fit (loose)		0.0008	0.020
Ring end gap	Top compression	0.030	0.762
	2nd compression	0.034	0.864
	Oil control rails	0.050	1.27
Ring side clearance	Top compression	0.0045	0.114
	2nd compression	0.0045	0.114
	Oil control rails	0.010	0.254

Table 3-20. Connecting Rod

CONNECTING ROD	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Piston pin fit (loose)	0.002	0.051
Side play between flywheels	0.020	0.508
Fit on crankpin (loose)	0.002	0.051

Table 3-21. Breather Assembly

BREATHER ASSEMBLY	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Breather cover warpage	0.005	0.13
Breather baffle warpage	0.005	0.13

Table 3-22. Valve Stem to Guide

VALVE STEM TO GUIDE	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Intake	0.0038	0.0965
Exhaust	0.0038	0.0965

Table 3-23. Flywheel

FLYWHEEL	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Runout (shaft measured in case)	0.012	0.305
Runout (measured in truing stand)	0.005	0.127
End play	0.013	0.330

Table 3-24. Crankshaft Roller Bearing

CRANKSHAFT ROLLER BEARING	REPLACE IF	
	IN.	MM
Roller bearing fit (loose)	More than 0.0015	More than 0.038
Bearing fit in crankcase (tight)	Less than 0.0038	Less than 0.097
Inner race on crankshaft (tight)	Less than 0.0004	Less than 0.010

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ENGINE OIL FLOW 3.4

OIL FEED

NOTE

The oiling system is carefully designed for optimum efficiency. All oil holes and passageways are specially sized. Exercise caution to avoid enlarging oil holes during cleaning. Any modification of the oiling system will adversely affect oil pressure or cooling and lubrication efficiency.

Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Top end oil flow is shown in Figure 3-2.

Oil flows from the oil pan through an internal passageway at the front of the transmission housing, and enters the lower passageway (A1) cast into the rear right side of the crankcase.

Running through a passageway in the crankcase, oil exits a hole in the crankcase flange (B2) and enters a hole on the inboard side of the cam support plate. Passing through a channel in the cam support plate (A3), the oil enters the feed side of the oil pump. See 3.5 OIL PUMP OPERATION. The feed gerotors of the pump direct the flow up a second channel in the cam support plate (A4).

A drilling in this channel connects to a pressure relief valve mounted in the bypass port of the cam support plate (A5). When the oil pressure exceeds the setting of the relief valve spring 35 psi (241.3 kPa), the orifice opens to bypass excess oil back to the feed side of the pump (A3).

Oil not returned to the feed side exits a hole on the inboard side of the cam support plate and passes through a hole in the crankcase flange (B6). Flowing through a passageway in the crankcase, where a reading is taken by the oil pressure sending unit (B7), the oil exits the lower off-center hole in the oil filter mount (D8).

After circulating through the oil filter, the flow of oil is directed back into the crankcase through the center hole in the oil filter mount (D9). Exiting a passageway in the crankcase through a hole in the crankcase flange (B10), the flow of oil reenters the cam support plate.

Filtered oil is then routed to the top and bottom ends of the engine as described in 3.4 ENGINE OIL FLOW, Top End and 3.4 ENGINE OIL FLOW, Bottom End which follow.

TOP END

Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Top end oil flow is shown in Figure 3-2.

Oil passes through a channel in the cam support plate exiting the inboard side through two holes near the top (A11, A12). Entering two holes in the crankcase flange (B13, B14), one leading to the front cylinder and the other to the rear, the oil travels through passageways in the crankcase to the hydraulic lifter bores (D15).

Exiting a hole in each lifter bore (E16), the oil flows around the lifter and enters a hole at the side of the lifter body. As the chamber inside the lifter body is filled, the push rod socket rises to achieve the no-lash fit of the valve train components. The flow of oil then exits a hole centered in the lifter socket and runs up the hollow push rods.

NOTE

Note that there is one additional hole drilled into the inside lifter bores while the oblong hole circulates oil around the lifter body as described, the round hole (E17) feeds oil to the piston jets in the flywheel compartment.

Exiting holes at the top of the hollow push rods, oil enters a hole at the bottom of the intake and exhaust rocker arms. Lubricating the rocker arm bushings, oil flows down the rocker arm shafts and exits a pin hole in the outboard side of each rocker arm housing (F18) where it sprays the valve springs and the top of the valve stem.

Oil runs down to the low side of the rocker housing and enters the exhaust valve spring pocket where a drain hole (G19) leads to a passageway in the cylinder head casting.

Oil exits the bottom of the cylinder head and passes through a dowel pin (H20) on the "down side" of the cylinder flange. The oil runs through a vertical passageway in the cylinder, passes through a second dowel pin on the "down side" of the cylinder deck (I21) and enters the left crankcase half.

Flowing through a horizontal passageway in the left crankcase half (J22), oil runs through a third dowel pin (K23) to the right crankcase half where it travels through another passageway before emptying into the cam compartment (B23, B24).

Oil collecting in the cam compartment is picked up by one of two scavenge lobes on the oil pump (B25).

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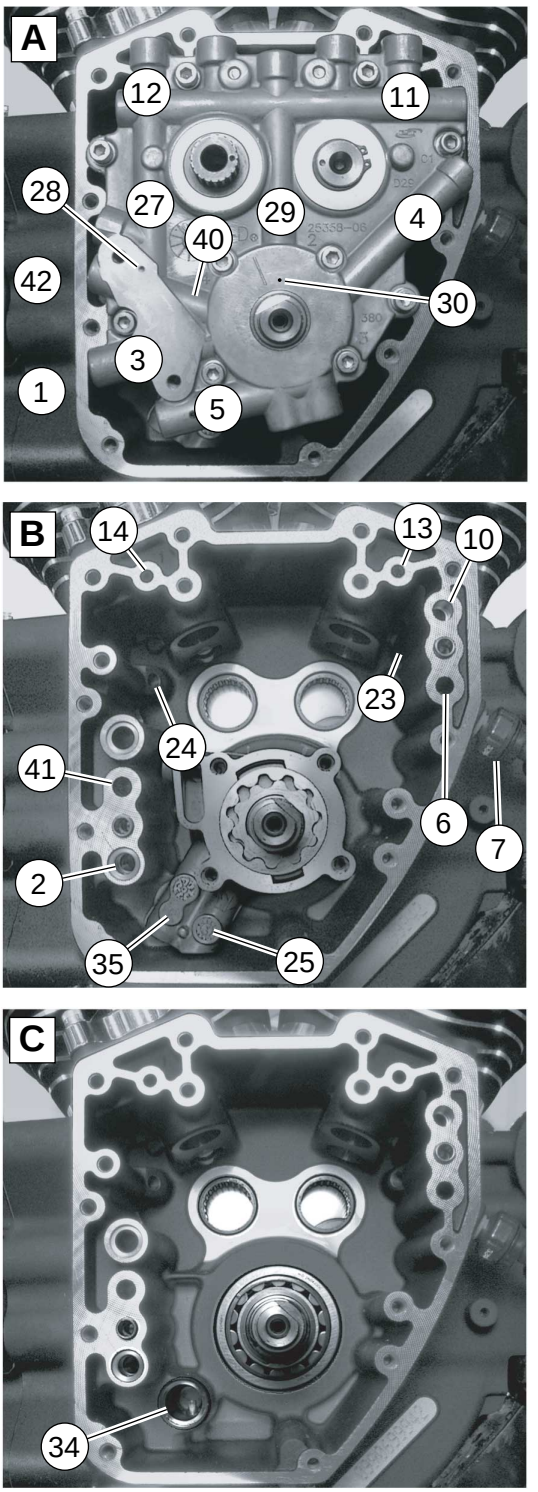


Figure 3-1. Engine Oil Flow - Cam Support Plate/Right Crankcase Half

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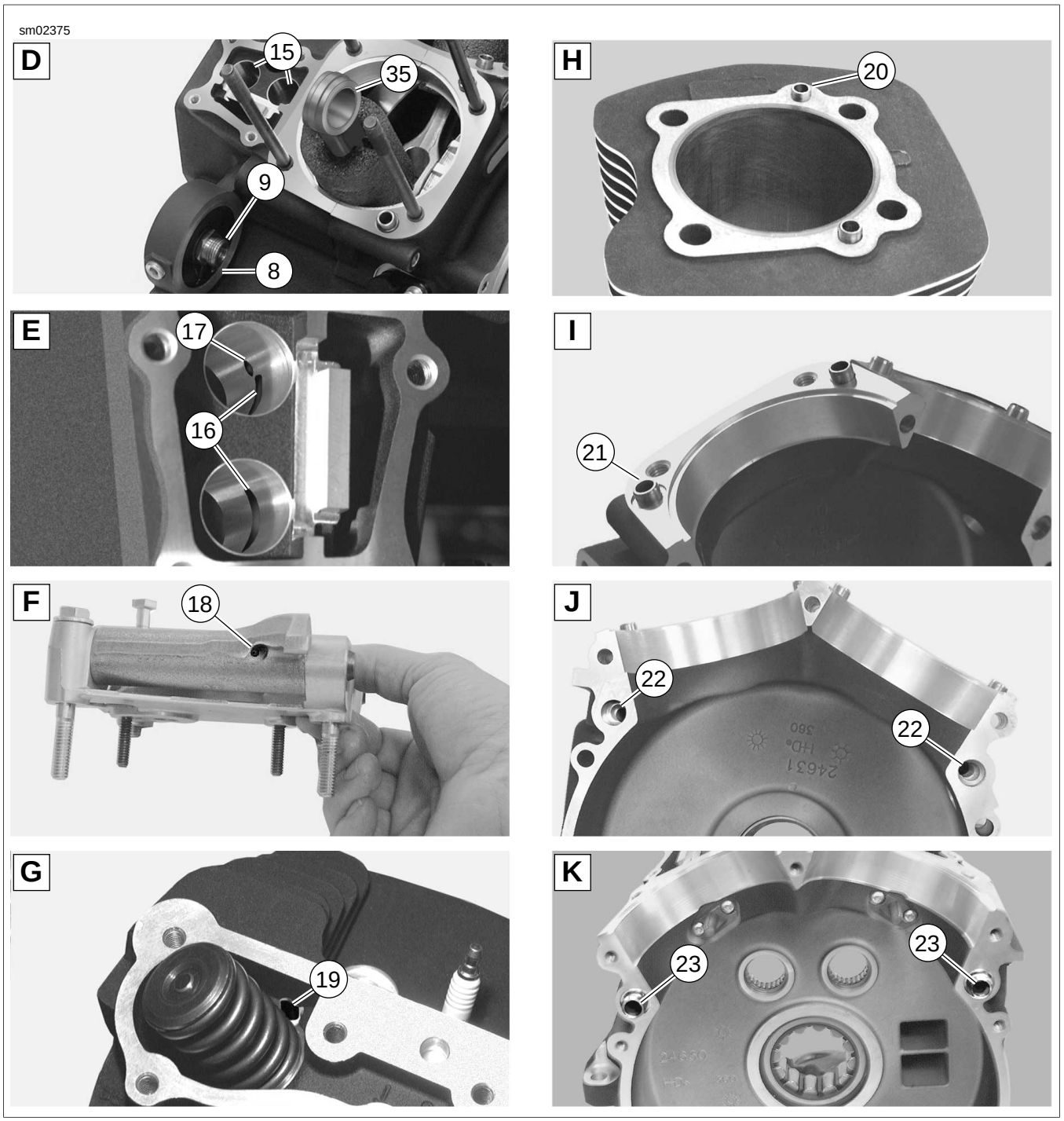


Figure 3-2. Engine Oil Flow - Top End

BOTTOM END

Three illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Top end oil flow is shown in Figure 3-2.
- Bottom end oil flow is shown in Figure 3-3.

Oil traveling through the horizontal passage at the top of the cam support plate (enroute to the front and rear cylinders) also passes through a hole at the top of each camshaft bore to lubricate the journals of the plain bearing cams. On the inboard side of the passage leading to the rear cylinder, oil sprays out through a pin hole to lubricate the secondary cam chain.

The flow of oil to the rear cylinder also travels down the vertical passage at the rear of the cam support plate (A27) and exits a hole on the outboard side to supply oil to the primary cam chain tensioner (A28).

The flow of oil in the vertical passage at the center of the cam support plate (A29) passes through a hole on the inboard side to supply oil to the secondary cam chain tensioner and also

sprays out through a pin hole on the outboard side to lubricate the primary cam chain (A30). The flow of oil then passes through a hole in the crankshaft bushing where it enters a drilling in the crankshaft (L31).

Oil runs down the center of the crankshaft and then up across drilling into the right side of the flywheel. The flow exits a drilling in the crank pin bore, enters the crank pin and then sprays out through three holes to lubricate the lower rod bearing set.

The oil splash and mist created by the action of the flywheel lubricates the crankshaft bearing and the camshaft needle bearings in the right crankcase half. This same action serves to lubricate the sprocket shaft bearing in the left crankcase half (M32).

Since the oil mist also lubricates the cylinder walls, three holes on each side of the piston (in the area of the third ring land) evacuate excess oil scraped from the walls on the piston downstroke.

The piston jets (N33), which receive a supply of oil from the intake lifter bores, spray the underside of the piston for cooling of the piston crown and skirt area. A check valve in each jet opens only when the oil pressure reaches 12-15 PSI (82.7-103.4 kPa), at which point the engine is operating above idle speed. At idle speeds (9-12 PSI (62.1-82.7 kPa)), the valve remains closed to prevent over oiling and to provide proper system operating pressure.

Oil spray from each piston jet also enters a hole at the bottom of each pin boss (O34) for lubrication of the piston pin. The spray also allows a portion of the oil to reach the upper rod bushing (D35).

Surplus oil falls back to the bottom of the flywheel compartment where it collects in the sump area (P36). Oil in the sump is drawn to the cam compartment through an internal channel (P37, C34) that connects with the second scavenge lobe of the oil pump (B35).

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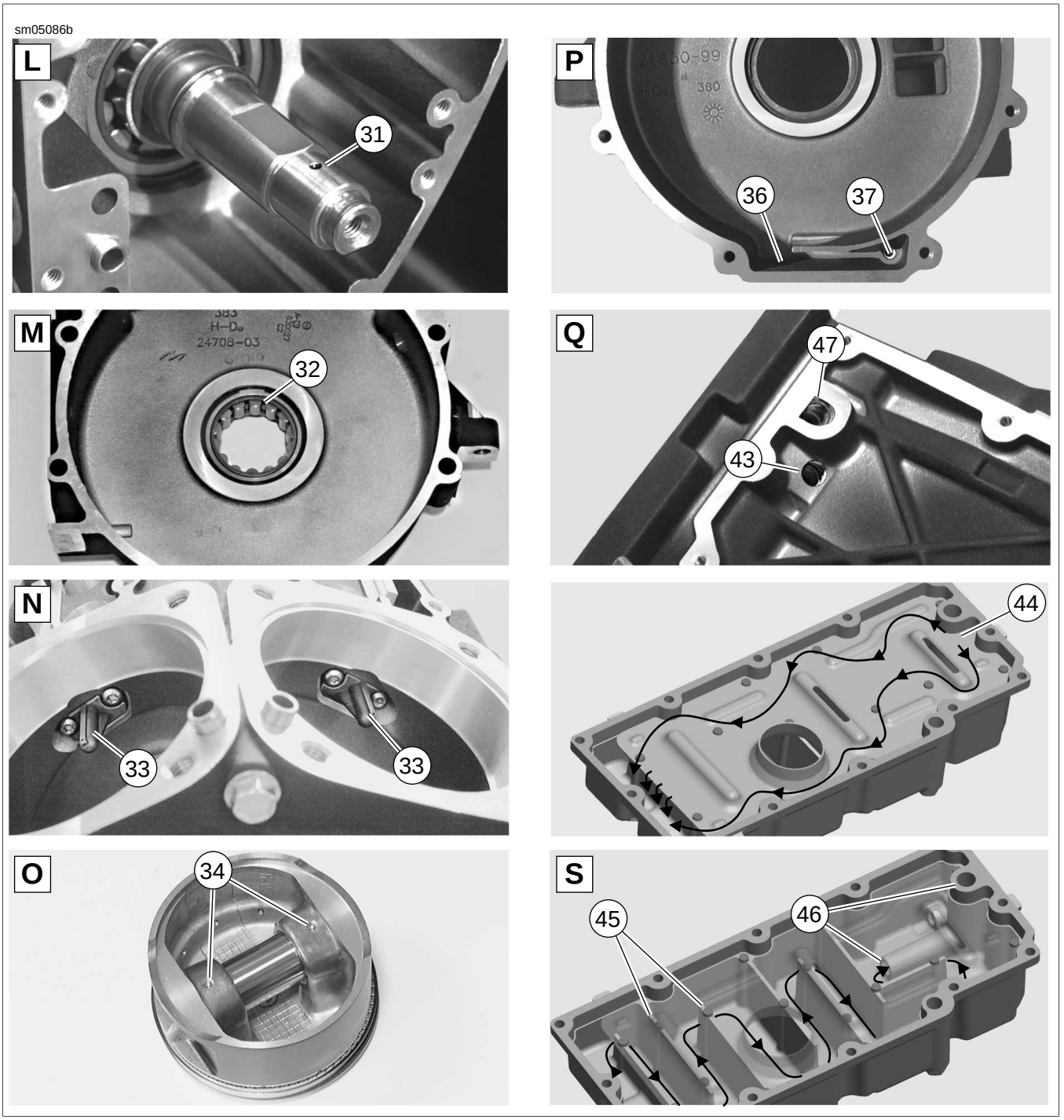


Figure 3-3. Engine Oil Flow - Bottom End

OIL RETURN

Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Bottom end oil flow is shown in Figure 3-3.

The "dual kidney" designation given to the oil pump refers to its two scavenging functions, whereby it simultaneously draws oil from both the cam and flywheel compartments.

Oil sucked up by the scavenge lobes passes through the scavenge gerotors of the oil pump and is directed through a return channel in the cam support plate (A40). See 3.5 OIL PUMP OPERATION.

Exiting a hole on the inboard side of the cam support plate, oil enters the upper hole in the crankcase flange (B41).

Oil flows through the upper passageway in the crankcase (A42), enters a passageway at the front of the transmission housing and empties into the oil pan (Q43) onto the front of the baffle plate (R44).

The oil flows to the rear of the oil pan along the top of the baffle plate, then drops from the open end of the baffle plate into the oil pan where it is redirected forward. The baffles (S45) cast into the oil pan slow the circulation of the oil through the pan to enhance cooling.

Oil pickup occurs in the front compartment of the baffle where a passageway in the casting (S46) directs the flow upward. Passing through a second passageway in the transmission housing (Q47), the flow of oil enters the lower passageway in the crankcase (A1) to repeat the circuit.

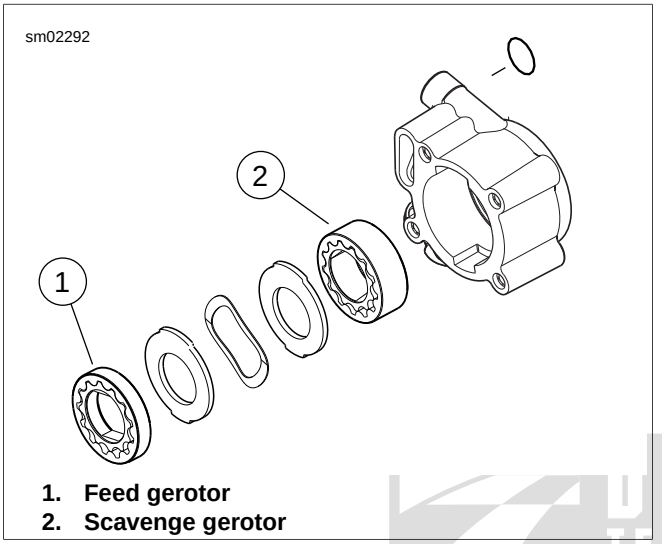
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OIL PUMP OPERATION 3.5

GENERAL

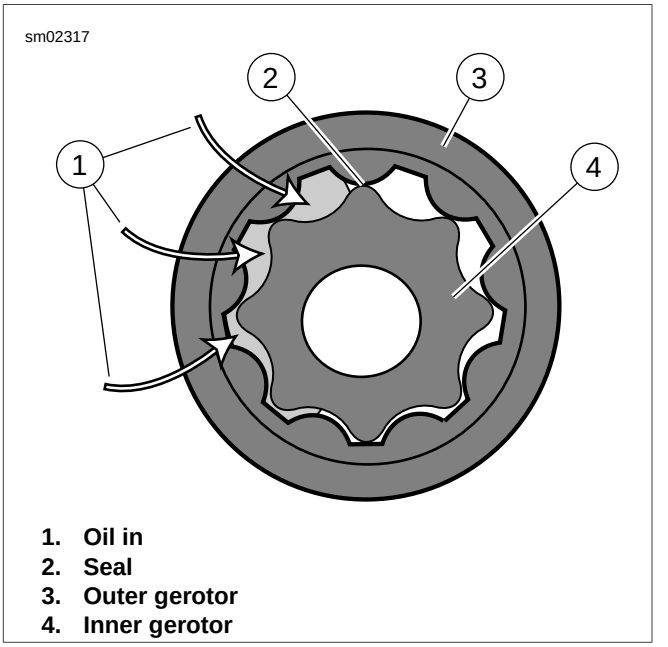
See Figure 3-4. The oil pump consists of a housing containing two gerotor gear sets, one feed and the other scavenge. Driven by the crankshaft, the feed gerotor set distributes oil to the engine, while the scavenge gerotor set draws oil from the cam and flywheel compartments and returns it to the oil pan.

Each gerotor gear set has two parts, an inner and outer gerotor. The inner and outer gerotors have fixed centers that are slightly offset to one another. Also, the inner gerotor has one less tooth.



1. **Feed gerotor**
2. **Scavenge gerotor**

Figure 3-4. Oil Pump Gerotors



1. **Oil in**
2. **Seal**
3. **Outer gerotor**
4. **Inner gerotor**

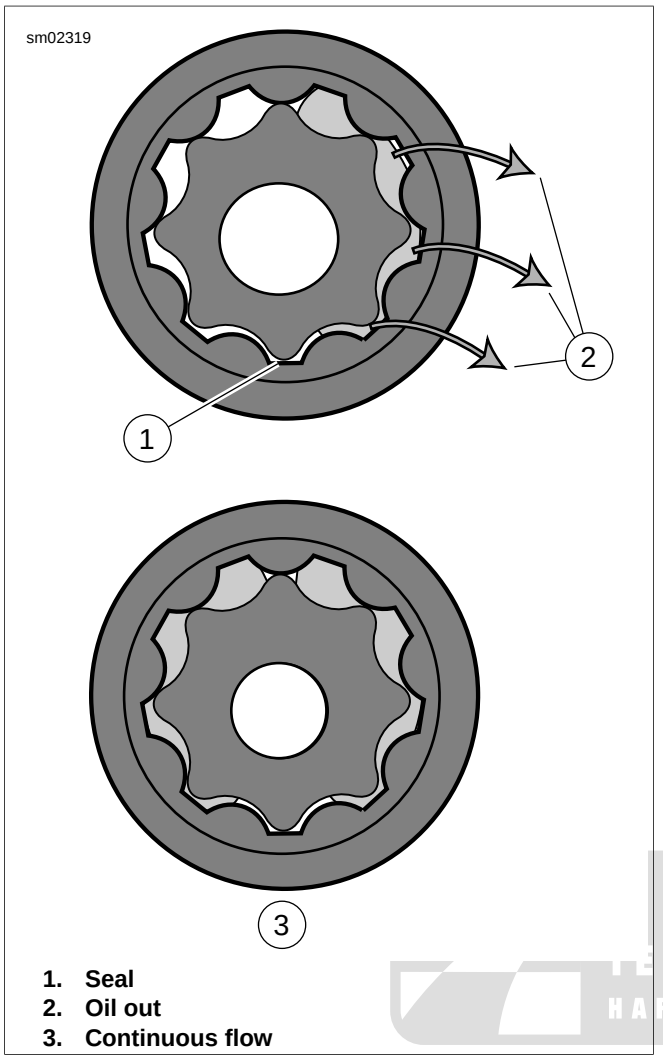
Figure 3-5. Inlet Side Oil Flow

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OPERATION

See Figure 3-5. As the crankshaft rotates, the cavity between the inner and outer gerotors on the inlet side of the pump increases in volume. This creates a vacuum causing oil to be drawn in. The cavity continues to increase until the volume is equivalent to that of the missing tooth on the inner gerotor. Note that the inlet and outlet sides of the pump are sealed by the tips and lobes of the inner and outer gerotors.

See Figure 3-6. Continued rotation moves the pocket of oil to the outlet side of the pump. In this area, the cavity decreases in volume as the gerotor teeth mesh causing the oil to be squeezed out the discharge port. As the cavity on the outlet side is emptied, a second seal formed by the tips and lobes of the inner and outer gerotors prevents oil on the outlet side (high pressure) from being transferred to the inlet side (low pressure). In operation, the gerotors provide a continuous flow of oil.



1. **Seal**
2. **Oil out**
3. **Continuous flow**

Figure 3-6. Outlet Side Oil Flow

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BREATHER OPERATION 3.6

GENERAL

The crankcase breather system relieves crankcase pressure produced by the downstroke of the pistons and allows crankcase vapors vacated from each cylinder to be directed into the air filter element. Through effective recirculation of crankcase vapors, the system serves to eliminate the pollutants normally discharged from the crankcase.

See Figure 3-7. As each piston pushes downward on its power and intake stroke, displaced air in the flywheel compartment is vented through the crankshaft roller bearing into the cam compartment and then up the push rod covers (1) into the rocker housing.

Air rushes under the rocker arm support plate, which is elevated slightly, and passes through an opening at the bottom of the plate to enter the breather baffle compartment (2).

In the baffle compartment, the flow of air passes upward through the oil filter gauze, where the oil is removed from the air. Two pin holes in the rocker arm support plate act as drain holes to rid the baffle compartment of the oil separated from the air.

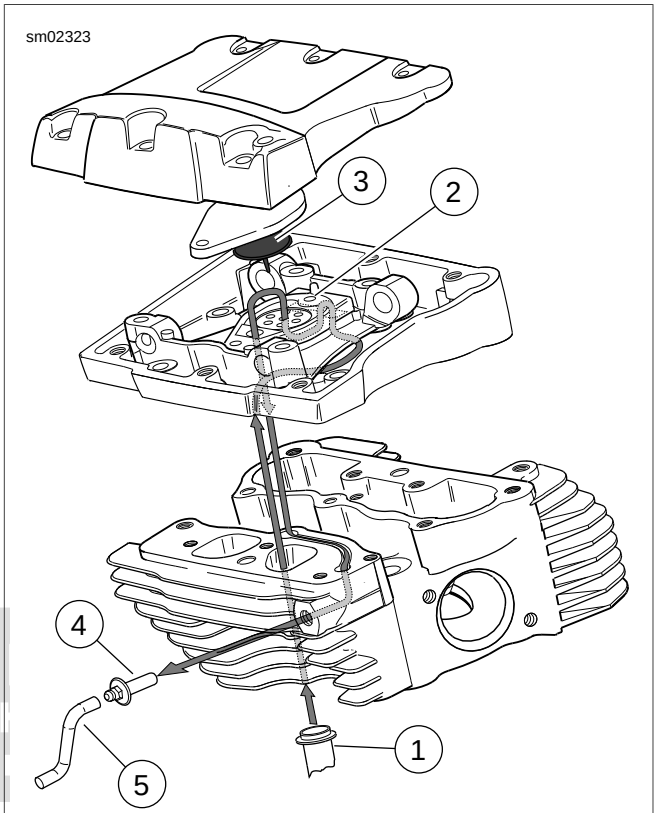
Passing through the oil filter gauze, the flow of air passes through the umbrella valve (3) into the breather compartment. The flaps of the umbrella valve only allow air to be vented one way, rising to allow the passage of air, but then falling back into place to seal the vent holes as the flow of air stops.

In the breather compartment, the flow of air reverses direction passing downward through holes aligned in the breather baffle, rocker arm support plate and rocker housing. Exiting the rocker housing, the air enters a passageway cast into the top of the cylinder head. Proper orientation of the rocker housing gasket is critical for effective sealing of this passageway.

Flowing through the cylinder head passageway, the air passes through a drilling in the air cleaner backplate bolt (4) and then through a breather tube (5) into the air filter element.

NOTE

Air cleaner mounting without installation of the breather tubes allows crankcase vapors to be vented into the atmosphere in violation of legal emissions standards.



1. **Push rod cover**
2. **Breather baffle compartment**
3. **Umbrella valve**
4. **Air cleaner backplate bolt**
5. **Breather tube**

Figure 3-7. Breather Air Flow

OIL PRESSURE 3.7

OIL PRESSURE INDICATOR LAMP

See Figure 3-8. The red OIL PRESSURE indicator lamp illuminates to indicate improper circulation of the engine oil. The lamp illuminates when the ignition is first turned on (before the engine is started), but should be extinguished once the engine is running.

CAUTION

If the oil pressure indicator lamp remains lit, always check the oil supply first. If the oil supply is normal and the lamp is still lit, stop the engine at once and do not ride further until the trouble is located and the necessary repairs are made. Failure to do so may result in engine damage. (00157a)

If the indicator lamp is not extinguished, it may be the result of a low oil level or diluted oil supply. In freezing weather, the oil feed and return lines can clog with ice or sludge. A problem in the lamp wiring, faulty oil pressure sending unit, damaged oil pump, plugged oil filter element, incorrect oil viscosity, broken or weak spring in the oil pressure relief valve and/or damaged or incorrectly installed O-rings in the engine may also cause the indicator lamp to remain on.

To troubleshoot the problem, always check the engine oil level first. If the oil level is OK, determine if oil returns to the oil pan. If oil does not return, shut off the engine until the problem is located and corrected.

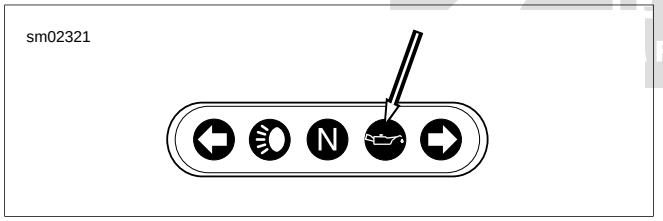


Figure 3-8. Oil Pressure Indicator Lamp

CHECKING OIL PRESSURE

PART NUMBER	TOOL NAME
HD-96921-52D	OIL PRESSURE GAUGE SET

Check operating oil pressure as follows:

1. Ensure engine oil is at the proper level. See 1.6 ENGINE OIL AND FILTER.
2. See Figure 3-9. Remove oil pressure switch from crankcase. See 7.25 OIL PRESSURE SWITCH AND SENDER.
3. See Figure 3-10. Install OIL PRESSURE GAUGE SET (Part No. HD-96921-52D).
 a. Install adapter (2) in oil pressure switch mounting hole. Tighten adapter until snug.
 b. Assemble banjo bolt (3), washer (4), oil pressure gauge (1) banjo fitting and second washer onto adapter and tighten until snug.
4. Start engine and allow to reach operating temperature.

NOTE

Engine oil should be at normal operating temperature, 230° F (110° C), for an accurate reading.

5. Oil pressure should be 30-38 PSI (207-262 kPa) at 2000 RPM and normal operating temperature.
6. Stop engine. Remove oil pressure gauge assembly from oil pressure switch mounting hole in crankcase.
7. Install oil pressure switch. See 7.25 OIL PRESSURE SWITCH AND SENDER.

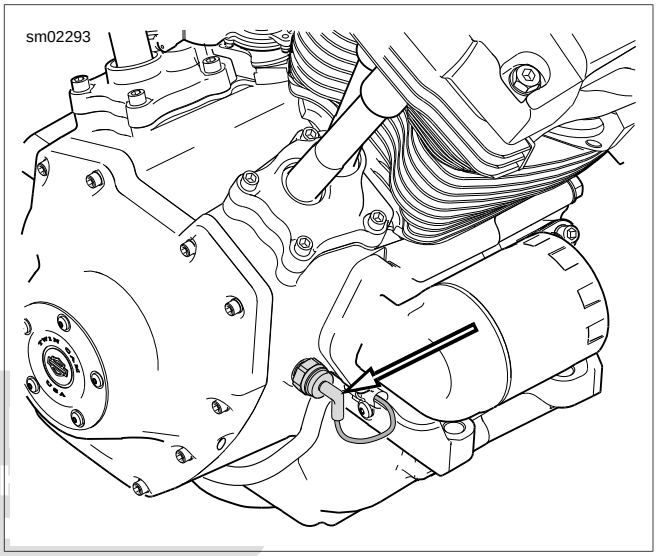
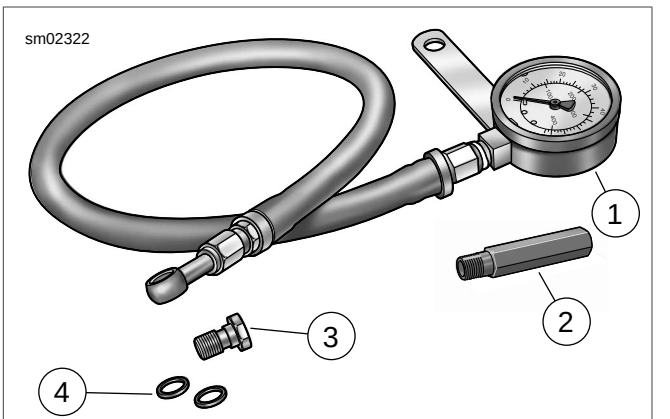


Figure 3-9. Oil Pressure Switch



1. **Gauge**
2. **Adapter**
3. **Banjo bolt**
4. **Washer (2)**

Figure 3-10. Oil Pressure Gauge Set

DIAGNOSING VALVE TRAIN NOISE

To diagnose and correct noisy hydraulic lifters and valve train components, use the following procedures:

1. With engine and oil at normal operating temperature, check oil pressure at 2000 RPM. If oil pressure is above 50 PSI (345 kPa) or below 5 PSI (34 kPa), inspect oil pump, crankcase passages, and oil hoses for restrictions or blockage. Repair or replace parts as necessary.
2. If oil is not reaching the hydraulic lifters, remove and inspect. See 3.22 PUSH RODS, LIFTERS AND COVERS, Lifter Inspection. Clean lifter bore of all foreign material. Replace hydraulic lifter if required.
3. Examine push rod, lifter and lifter block for proper fit and any signs of unusual wear. Replace parts as necessary.
4. Visually inspect camshaft lobes for abnormal wear.
5. Check cam chain tensioning shoe for wear.
6. Remove cylinder head and rocker box assemblies. Check rocker arm end play and check for binding. Inspect valve stems for scuffing and check stem to guide clearance. Check valve seats for signs of looseness or shifting.
7. Grind valves and valve seats. See 3.23 CYLINDER HEAD, Valve and Seat Refacing.

COMPRESSION TEST

PART NUMBER	TOOL NAME
HD-33223-1	CYLINDER COMPRESSION GAUGE

Satisfactory engine performance depends upon a mechanically sound engine. In many cases, unsatisfactory performance is caused by combustion chamber leakage. A compression test can help determine the source of cylinder leakage. Use CYLINDER COMPRESSION GAUGE (Part No. HD-33223-1).

A proper compression test should be performed with the engine at normal operating temperature when possible.

1. Disconnect spark plug wires, clean around plug base and remove plugs.
2. Remove air cleaner. See 4.4 AIR CLEANER ASSEMBLY.
3. Connect compression tester to front cylinder per manufacturer's instructions.
4. Make sure transmission is in neutral. With throttle body butterfly plate in wide open position, crank engine continuously through 5 to 7 full compression strokes.
5. Note gauge readings at the end of the first and last compression strokes. Record test results.
6. Repeat compression test on rear cylinder.
7. If the final readings are 125 PSI (862 kPa) or more, and if the final readings do not indicate more than a 10% variance between cylinders, compression is considered normal. If compression does not meet specifications, refer to Table 3-25.
8. Inject approximately 1/2 oz. (15 ml) engine oil into each cylinder and repeat the compression tests on both cylinders. Readings that are considerably higher during the second test indicate worn piston rings.

NOTE

After installing spark plugs, be sure that throttle plate is in the closed position before starting the engine.

Table 3-25. Compression Test Results

DIAGNOSIS	TEST RESULTS
Ring trouble	Compression low on first stroke, tends to build up on the following strokes, but does not reach normal. Improves considerably when oil is added to cylinder.
Valve trouble	Compression low on first stroke, does not build up much on following strokes. Does not improve considerably with the addition of oil. Check for correct push rod length.
Head gasket leak	Same reaction as valve trouble.

CYLINDER LEAKDOWN TEST

PART NUMBER	TOOL NAME
HD-35667-A	CYLINDER LEAKDOWN TESTER

NOTE

On vehicles with automatic compression release (ACR), make sure the ACRs are closed for this test. Either perform the test with the ignition/light switch in the off position or with the system relay removed.

The cylinder leakage test will pinpoint engine problems including leaking valves, worn, damaged or stuck piston rings and blown head gaskets. The cylinder leakage tester applies compressed air to the cylinder at a controlled pressure and volume and measures the percent of leakage from the cylinder.

Use the CYLINDER LEAKDOWN TESTER (Part No. HD-35667-A) and follow the specific instructions supplied with the tester.

The following are some general instructions that apply to Harley-Davidson V-twin engines:

1. Run engine until it reaches normal operating temperature.
2. Stop engine. Clean dirt from around spark plugs and remove the spark plugs.
3. Remove the air cleaner and set the throttle to the wide open position.
4. The piston in the cylinder being tested must be at top dead center of compression stroke (both valves closed) during the test.
5. To keep the engine from turning over when air pressure is applied to the cylinder, engage transmission in highest gear and lock the rear brake.

NOTE

Before performing the cylinder leakage test, verify that the tester itself is free from leakage to obtain the most accurate test results. With a soap solution (applied around all tester fittings), connect the cylinder leakdown tester to the compressed air source and look for any bubbles that would indicate leakage from the tester.

6. Following the manufacturer's instructions, perform a cylinder leakage test on the front cylinder. Make a note of the percent of leakage. Leakage greater than 10% indicates internal engine problems.
7. Listen for air leaks at throttle body intake, exhaust pipe, and head gasket. Air escaping through the throttle body indicates a leaking intake valve. Air escaping through the exhaust pipe indicates a leaking exhaust valve.

NOTE

If air is escaping through valves, check for correct push rod length.

8. Repeat procedure on rear cylinder.

NOTE

After installing spark plugs, be sure that throttle plate is in the closed position before starting the engine.

DIAGNOSING SMOKING ENGINE OR HIGH OIL CONSUMPTION

Perform both a compression test and a cylinder leakage test. See 3.8 TROUBLESHOOTING, Compression Test and 3.8 TROUBLESHOOTING, Cylinder Leakdown Test. If further testing is needed, remove suspect head(s) and inspect for the following:

Check Prior To Cylinder Head Removal

1. Oil level overfull.
2. Oil carryover.
3. Breather hose restricted.
4. Restricted oil filter.

Check After Cylinder Head Removal

1. Oil return passages for clogging.
2. Valve guide seals.
3. Valve guide to valve stem clearance.
4. Gasket surface of both head and cylinder.
5. Cylinder head casting's porosity allowing oil to drain into combustion chamber.
6. O-ring damaged or missing from oil pump/crankcase junction.

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HOW TO USE THIS SECTION 3.9

GENERAL

Three basic levels of service are presented in this section: top end overhaul, bottom end overhaul and subassembly service and repair. The manner in which these instructions are used depends upon the level of disassembly required.

TOP END OVERHAUL

If servicing only top end components, see 3.12 STRIPPING MOTORCYCLE FOR SERVICE , and then proceed to 3.16 TOP END OVERHAUL: DISASSEMBLY. During top end disassembly, the engine may be left in the chassis for service.

NOTE

If the engine is to be removed from the chassis, see 3.14 REMOVING ENGINE FROM CHASSIS in lieu of 3.12 STRIPPING MOTORCYCLE FOR SERVICE.

In the top end disassembly instructions, references are made to 3.20 BREATHER ASSEMBLY through 3.25 PISTON for service of all top end subassemblies: breathers, rocker arms, pushrods, cylinder heads, cylinders, pistons and upper connecting rods.

To rebuild the engine after a top end overhaul is complete, perform the steps under 3.17 TOP END OVERHAUL: ASSEMBLY, immediately following the disassembly instructions. Then, refer to 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE to complete the project.

NOTE

For clarity, all artwork in this section shows the engine removed from the chassis for service.

Table 3-26. Top End Service

TOP END SERVICE	
Engine in Chassis	**Engine Removed**
Stripping Motorcycle For Service.	Removing Engine From Chassis.
Top End Overhaul, Disassembly.	Top End Overhaul, Disassembly.
Subassembly Service and Repair, Top End.	Subassembly Service and Repair, Top End.
Top End Overhaul, Assembly.	Top End Overhaul, Assembly.
Assembling Motorcycle After Service.	Installing Engine In Chassis.

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BOTTOM END OVERHAUL

Bottom end service may require either partial or complete disassembly of the engine. Servicing components in the cam compartment requires only partial disassembly, while servicing those in the flywheel compartment requires complete disassembly. An easy rule to remember is that any time the crankcase halves must be split, complete disassembly needs to occur. The cam compartment can be accessed through removal of the cam cover making complete engine disassembly unnecessary.

During bottom end service that requires complete disassembly, the engine must be removed from the chassis and placed in an engine stand. To begin, see 3.14 REMOVING ENGINE FROM CHASSIS.

After the motorcycle has been stripped and the engine removed, follow all of the steps under 3.16 TOP END OVERHAUL: DISASSEMBLY. When finished, continue with disassembly of the bottom half by performing those steps listed under 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.

As with the top end disassembly instructions, references are made to 3.26 CAM SUPPORT PLATE AND COVER through 3.29 FLYWHEEL AND CONNECTING RODS for service of bottom end subassemblies- cam support plate, oil pump, crankcase and flywheel.

Since it is standard practice to inspect and clean all oil passages when the engine is completely disassembled, a detailed explanation of the engine oil circuit is presented under 3.4 ENGINE OIL FLOW.

To rebuild the engine after a bottom end overhaul is complete, perform the steps under 3.19 BOTTOM END OVERHAUL: ASSEMBLY, and then proceed to 3.17 TOP END OVERHAUL: ASSEMBLY, to rebuild the upper end.

Once the engine is assembled, refer to 3.15 INSTALLING ENGINE IN CHASSIS to complete the project.

The flow charts in this section show how the same subsections are used for various levels of service.

Table 3-27. Bottom End Service

BOTTOM END SERVICE	
Engine in Chassis (Cam Compartment)	**Engine Removed (Flywheel Compartment or Complete Engine Overhaul)**
Stripping Motorcycle For Service.	Removing Engine From Chassis.
Top End Overhaul, Disassembly.	Top End Overhaul, Disassembly.
Bottom End Overhaul, Disassembly.	Bottom End Overhaul, Disassembly.
Subassembly Service and Repair, Bottom End.	Subassembly Service and Repair, Top End.
Bottom End Overhaul, Assembly.	Subassembly Service and Repair, Bottom End.
Top End Overhaul, Assembly.	Bottom End Overhaul, Assembly.
Assembling Motorcycle After Service.	Top End Overhaul, Assembly.
	Installing Engine In Chassis.

SUBASSEMBLY SERVICE AND REPAIR

Finally, if the task entails servicing of only one particular subassembly, then move directly to the appropriate section for all service instructions.

For example, if just installing new cams, then refer to 3.26 CAM SUPPORT PLATE AND COVER.

The specific steps under 3.17 TOP END OVERHAUL: ASSEMBLY and 3.19 BOTTOM END OVERHAUL: ASSEMBLY that need to be followed for the removal and installation of the cam support plate are given.

Furthermore, detailed instructions for disassembling, cleaning, inspecting, replacing and assembling cam support plate components are provided.

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TOP END SERVICE 3.10

ENGINE IN CHASSIS

Table 3-28. Engine In Chassis

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURE
Remove parts to gain access to all components above cylinder deck. See 3.12 STRIPPING MOTORCYCLE FOR SERVICE.		
Disassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY	Inspect and repair. See 3.20 BREATHER ASSEMBLY*.
	ROCKER ARM SUPPORT	Inspect and repair. See 3.21 ROCKER ARM SUPPORT PLATE*.
	PUSH RODS, LIFTERS AND COVERS	Inspect and repair. See 3.22 PUSH RODS, LIFTERS AND COVERS*.
	CYLINDER HEAD	Inspect and repair. See 3.23 CYLINDER HEAD*.
	CYLINDER	Inspect and repair. See 3.24 CYLINDER*.
	PISTON	Inspect and repair. See 3.25 PISTON*.
Assemble top end. See 3.17 TOP END OVERHAUL: ASSEMBLY.		
Assemble motorcycle. See 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE.		
Note: * If no other work is to be done, you may advance to 3.17 TOP END OVERHAUL: ASSEMBLY when this step is completed during top end service.		

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ENGINE REMOVED FROM CHASSIS

Table 3-29. Engine Removed From Chassis

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURE
Remove engine from motorcycle. See 3.14 REMOVING ENGINE FROM CHASSIS.		
Disassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY	Inspect and repair. See 3.20 BREATHER ASSEMBLY*.
	ROCKER ARM SUPPORT	Inspect and repair. See 3.21 ROCKER ARM SUPPORT PLATE*.
	PUSH RODS, LIFTERS AND COVERS	Inspect and repair. See 3.22 PUSH RODS, LIFTERS AND COVERS*.
	CYLINDER HEAD	Inspect and repair. See 3.23 CYLINDER HEAD*.
	CYLINDER	Inspect and repair. See 3.24 CYLINDER*.
	PISTON	Inspect and repair. See 3.25 PISTON.
Assemble top end. See 3.17 TOP END OVERHAUL: ASSEMBLY.		
Install engine in motorcycle. See 3.15 INSTALLING ENGINE IN CHASSIS.		
Note: * If no other work is to be done, you may advance to 3.17 TOP END OVERHAUL: ASSEMBLY when this step is completed during top end service.		

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BOTTOM END SERVICE 3.11

ENGINE IN CHASSIS

Table 3-30. Engine In Chassis: Cam Compartment Service

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURES
Remove parts to gain access to all components above cylinder deck. See 3.12 STRIPPING MOTORCYCLE FOR SERVICE.		
Dissassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY.	Inspect and repair. See 3.20 BREATHER ASSEMBLY.
	ROCKER ARM SUPPORT PLATE.	Inspect and repair. See 3.21 ROCKER ARM SUPPORT PLATE.
	PUSH RODS, LIFTERS AND COVERS.	Inspect and repair. See 3.22 PUSH RODS, LIFTERS AND COVERS.
Disassemble bottom end. See 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.		
	COVER AND CAM SUPPORT PLATE	Inspect and repair. See 3.26 CAM SUPPORT PLATE AND COVER*.
	OIL PUMP	Inspect and repair. See 3.27 OIL PUMP.
Assemble bottom end. See 3.19 BOTTOM END OVERHAUL: ASSEMBLY.		
Assemble motorcycle. See 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE.		
Note: * If no other work is to be done, you may advance to 3.19 BOTTOM END OVERHAUL: ASSEMBLY when this step is completed during bottom end service.		

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

ENGINE REMOVED FROM CHASSIS

Table 3-31. Engine Removed: Flywheel Compartment Service or Complete Engine Overhaul

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURES
Remove engine from motorcycle. See 3.14 REMOVING ENGINE FROM CHASSIS.		
Dissassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY.	Inspect and repair. See 3.20 BREATHER ASSEMBLY.
	ROCKER ARM SUPPORT PLATE.	Inspect and repair. See 3.21 ROCKER ARM SUPPORT PLATE.
	PUSH RODS, LIFTERS AND COVERS.	Inspect and repair. See 3.22 PUSH RODS, LIFTERS AND COVERS.
	CYLINDER HEAD	Inspect and repair. See 3.23 CYLINDER HEAD.
	CYLINDER	Inspect and repair. See 3.24 CYLINDER.
	PISTON	Inspect and repair. See 3.25 PISTON.
Disassemble bottom end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	COVER AND CAM SUPPORT PLATE	Inspect and repair. See 3.26 CAM SUPPORT PLATE AND COVER.
	CRANKCASE	Inspect crankcase and repair. See 3.28 CRANKCASE.
		Inspect and repair flywheel/connecting rod assembly. See 3.29 FLYWHEEL AND CONNECTING RODS.
Assemble bottom end. See 3.19 BOTTOM END OVERHAUL: ASSEMBLY.		
Assemble top end. See 3.17 TOP END OVERHAUL: ASSEMBLY.		
Install engine in motorcycle. See 3.15 INSTALLING ENGINE IN CHASSIS.		

DIGITAL TECHNICIAN HARLEY-DAVIDSON

STRIPPING MOTORCYCLE FOR SERVICE 3.12

PROCEDURE

Cam Compartment Service Only

1. Remove exhaust system. See 4.19 EXHAUST SYSTEM.
2. Remove fuel tank. See 4.5 FUEL TANK.
3. Remove air cleaner and backplate. See 4.4 AIR CLEANER ASSEMBLY.
4. Remove spark plug cables. Remove spark plugs. See 1.20 SPARK PLUGS.
5. Remove purge solenoid hose, if equipped, from induction module. See 4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS).

Top End Service

1. Complete all steps under Cam Compartment Service Only.
2. Remove induction module. See 4.13 INDUCTION MODULE.
3. Gather disconnected branches of main harness and tape to top of wire trough to keep out of the way.
4. Remove two hex head bolts (with flat washers) to release top engine mounting bracket from front cylinder head. Remove hex head bolt to release stabilizer link from frame weldment.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

ASSEMBLING MOTORCYCLE AFTER SERVICE 3.13

PROCEDURE

After Top End Service

1. Start two hex head bolts (with flat washers) to fasten top engine mounting bracket to front cylinder head. Alternately tighten bolts to 30-35 ft-lbs (41-48 Nm).
2. Start hex head bolt to fasten stabilizer link to frame weldment. Tighten bolt to 30-35 ft-lbs (41-48 Nm).
3. Start bolt (with flat washer) to fasten horn bracket to front cylinder head.
4. Remove tape to release disconnected branches of main harness from top of wire trough.
5. Install induction module. See 4.13 INDUCTION MODULE.
6. Continue with steps under After Cam Compartment Service.

After Cam Compartment Service

1. Install purge solenoid hose, if equipped, to induction module. See 4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS).
2. Install spark plugs and connect spark plug cables.
3. Install backplate and air cleaner. See 4.4 AIR CLEANER ASSEMBLY.
4. Install fuel tank. See 4.5 FUEL TANK.
5. Install exhaust system. See 4.19 EXHAUST SYSTEM.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

REMOVING ENGINE FROM CHASSIS 3.14

PROCEDURE

PART NUMBER	TOOL NAME
HD-42310	BENCH STAND
HD-42310-2	TWIN CAM 88 CRADLE
HD-43646A	ROLLING STAND

1. Remove exhaust system. See 4.19 EXHAUST SYSTEM.
2. Remove fuel tank. See 4.5 FUEL TANK.
3. Remove air cleaner and backplate. See 4.4 AIR CLEANER ASSEMBLY.
4. Remove spark plug cables. Remove spark plugs. See 1.20 SPARK PLUGS.
5. Remove purge solenoid hose, if equipped, from induction module. See 4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS).
6. Remove induction module. See 4.13 INDUCTION MODULE.
7. Gather disconnected branches of main harness and tape to top of wire trough. If wiring is not moved out of the way, it may be damaged during engine removal.
8. Remove voltage regulator. See 7.3 VOLTAGE REGULATOR.
9. Remove CKP sensor. See 7.21 CRANKSHAFT POSITION SENSOR (CKP).
10. Remove oil filter. See 1.6 ENGINE OIL AND FILTER.
11. Remove oil pressure switch/sender. See 7.25 OIL PRESSURE SWITCH AND SENDER.
12. Coil main harness conduit and allow to hang below lower frame tube at front of motorcycle. If wiring is not moved out of the way, it may be damaged during engine removal.
13. Remove primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.
14. Remove rotor and stator. See 7.22 ALTERNATOR.
15. Wrap rear master cylinder reservoir with foam padding or bubble pack.
16. Cover lower frame tubes (both left and right side) with foam padding or bubble pack. Split loom conduit or a half shell of PVC tubing will also produce good results. Protection is necessary to prevent nicks or paint damage to left frame tube and chafing, cutting or kinking of the brake line and main harness conduit at the top of the right frame tube.
17. Cover rocker covers of front and rear cylinders with foam padding or bubble pack.
18. Place a jack under the oil pan and use a block of wood between the jack and oil pan to distribute pressure across the length of the casting. Raise the jack until firm contact is made with the bottom of the oil pan.
19. Remove two hex head bolts (with flat washers) to release top engine mounting bracket from front cylinder head. Remove hex head bolt to release stabilizer link from frame weldment.
20. Remove four bolts (with flat washers) to free transmission from crankcase. Loosen and remove bolts in a crosswise pattern.
21. Remove front engine mount. See 2.54 FRONT ENGINE MOUNT.
22. Move engine forward far enough to clear two ring dowels at bottom of transmission flange. Raise engine and remove from right side of motorcycle. Exercise caution to avoid contact with rear brake line and main harness conduit at top of lower frame tube. Also be sure to avoid the rear brake master cylinder reservoir.
23. See Figure 3-11. Using the TWIN CAM 88 CRADLE (Part No. HD-42310-2), install engine in BENCH STAND (Part No. HD-42310) or ROLLING STAND (Part No. HD-43646A).
24. Thoroughly wipe all engine oil from pockets in crankcase flange. Remove gasket pulling two index pins from holes in transmission flange. Discard gasket.
25. Remove and clean the oil pan under any of the following conditions. See 3.30 OIL PAN.
 a. Metal debris is found in the engine or crankcase.
 b. Oil contamination is suspected.
 c. A complete engine overhaul is being performed as a result of a major engine failure.
 d. The engine is being replaced with a new one.

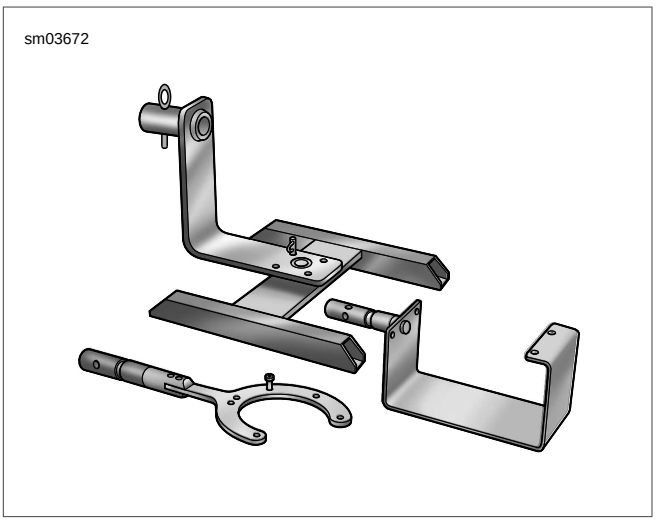


Figure 3-11. Engine/Transmission Bench Stand (HD-42310)

INSTALLING ENGINE IN CHASSIS 3.15

PROCEDURE

PART NUMBER	TOOL NAME
HD-42310	BENCH STAND
HD-43646A	ROLLING STAND
SNAP-ON FC018	OPEN END CROWFOOT

1. Install oil pan, if removed. See 3.30 OIL PAN.
2. Cover rocker covers of front and rear cylinders with foam padding or bubble pack.
3. Cover lower frame tubes (both left and right side) with foam padding or bubble pack. Split loom conduit or a half shell of PVC tubing will also produce good results. Protection is necessary to prevent nicks or paint damage to left frame tube and chafing, cutting or kinking of the brake line and main harness conduit at the top of the right frame tube.
4. Wrap rear master cylinder reservoir with foam padding or bubble pack.
5. Remove engine from BENCH STAND (Part No. HD-42310) or ROLLING STAND (Part No. HD-43646A) and set on floor on right side of chassis.
6. Raise engine and install in chassis from right side of motorcycle setting front of crankcase onto front engine mounting bracket. Engine must be set forward far enough to clear two ring dowels in lower flange of transmission. Exercise caution to avoid contact with rear brake master cylinder reservoir. Also be sure to avoid brake line and main harness conduit at top of lower right frame tube.
7. Install **new** gasket engaging two index pins in holes at center of transmission flange. Move engine rearward to fully engage two ring dowels at bottom of transmission flange.
8. Install front engine mount. Install but do not tighten crankcase to front engine mounting bracket fasteners at this time. See 2.54 FRONT ENGINE MOUNT.
9. Secure the engine as follows:
 a. Using a crosswise pattern, hand tighten four bolts (with flat washers) to secure transmission to crankcase. Install the shorter 1/2 inch bolts at the top, the longer 9/16 inch bolts at the bottom.
 b. Hand tighten two bolts (with flat washers) to secure front of crankcase to front engine mounting bracket.
 c. Alternately tighten the four transmission to crankcase bolts to 15 ft-lbs (20.3 Nm) in the crosswise pattern previously used.

NOTE

For best results, use OPEN END CROWFOOT (Part No. Snap-On FC018) on upper left and upper right transmission to crankcase bolts.

 d. Repeating the crosswise pattern again, final tighten the four transmission to crankcase bolts to 34-39 ft-lbs (46.1-52.9 Nm).
 e. Install two hex head bolts through bottom of engine mounting bracket. Install nuts (with flat washers) to fasten crankcase to front engine mounting bracket. Alternately tighten bolts to 36-40 ft-lbs (48.8-54.2 Nm).
 f. Install two hex head bolts (with flat washers) to secure top engine mounting bracket to front cylinder head. Alternately tighten bolts to 30-35 ft-lbs (41-48 Nm).
 g. Install hex head bolt to secure stabilizer link to frame weldment. Tighten bolt to 30-35 ft-lbs (41-48 Nm).
10. Remove jack and wooden block from under oil pan.
11. Install oil filter. See 1.6 ENGINE OIL AND FILTER.
12. Install stator and rotor. See 7.22 ALTERNATOR.
13. Install primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.
14. Uncoil main harness conduit and allow to hang below lower frame tube at front of motorcycle.
15. Install oil pressure switch/sender. See 7.25 OIL PRESSURE SWITCH AND SENDER.
16. Install CKP sensor. See 7.21 CRANKSHAFT POSITION SENSOR (CKP).
17. Install voltage regulator. See 7.3 VOLTAGE REGULATOR.
18. Remove tape to release disconnected branches of main harness from top of wire trough.
19. Install induction module. See 4.13 INDUCTION MODULE.
20. Install purge solenoid hose, if equipped, to induction module. See 4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS).
21. Install spark plugs. See 1.20 SPARK PLUGS.
22. Install spark plug cables.
23. Install backplate and air cleaner. See 4.4 AIR CLEANER ASSEMBLY.
24. Install fuel tank. See 4.5 FUEL TANK.
25. Install exhaust system. See 4.19 EXHAUST SYSTEM.
26. Verify proper oil level. See 1.6 ENGINE OIL AND FILTER.
 a. If oil pan was drained, add appropriate amount and type of engine oil before checking oil level.
 b. If oil pan was **not** drained, perform **COLD CHECK** and **HOT CHECK** only.

TOP END OVERHAUL: DISASSEMBLY 3.16

GENERAL

It is assumed that each step performed on one cylinder is automatically repeated on the other.

To perform a complete top end overhaul, follow all steps listed in this section including inspection and repair procedures.

ROCKER COVERS

PART NUMBER	TOOL NAME
HD-47248	LOWER ROCKER BOX WRENCH
HD-47258	UPPER ROCKER BOX WRENCH

NOTE

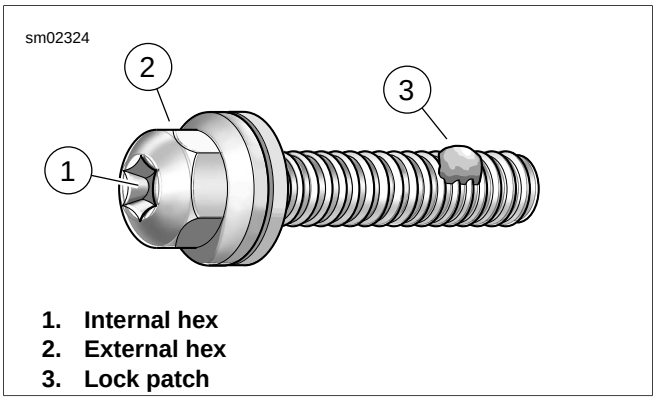
Dirt caked on cooling fins and other areas can fall into crankcase bore or stick to subassemblies as parts are removed. Abrasive particles can damage machined surfaces or plug oil passageways. Remove all dirt and particles before disassembly to prevent component damage.

1. Use low pressure spray to thoroughly clean exterior surfaces of engine prior to disassembly.

NOTE

See Figure 3-12. If the engine is left in the chassis for service, use the UPPER ROCKER BOX WRENCH (Part No. HD-47258) and LOWER ROCKER BOX WRENCH (Part No. HD-47248) to remove the rocker cover and rocker housing bolts, respectively. These tools are especially useful when removing the bolts on the left side of the engine (particularly the rear) where there is close proximity to the frame. With both an external and internal hex, the bolts also can be removed with either a 7/16 inch socket or open end/box wrench (open spaces), or a short 3/16 inch allen wrench (tight spaces).

2. See Figure 3-13. Following the sequence shown, alternately loosen the six rocker cover bolts. Remove the rocker cover bolts and their captive washers.
3. Remove the rocker cover and gasket. Discard gasket.



1. **Internal hex**
2. **External hex**
3. **Lock patch**

Figure 3-12. Rocker Cover Bolt (Rocker Housing Bolt Similar)

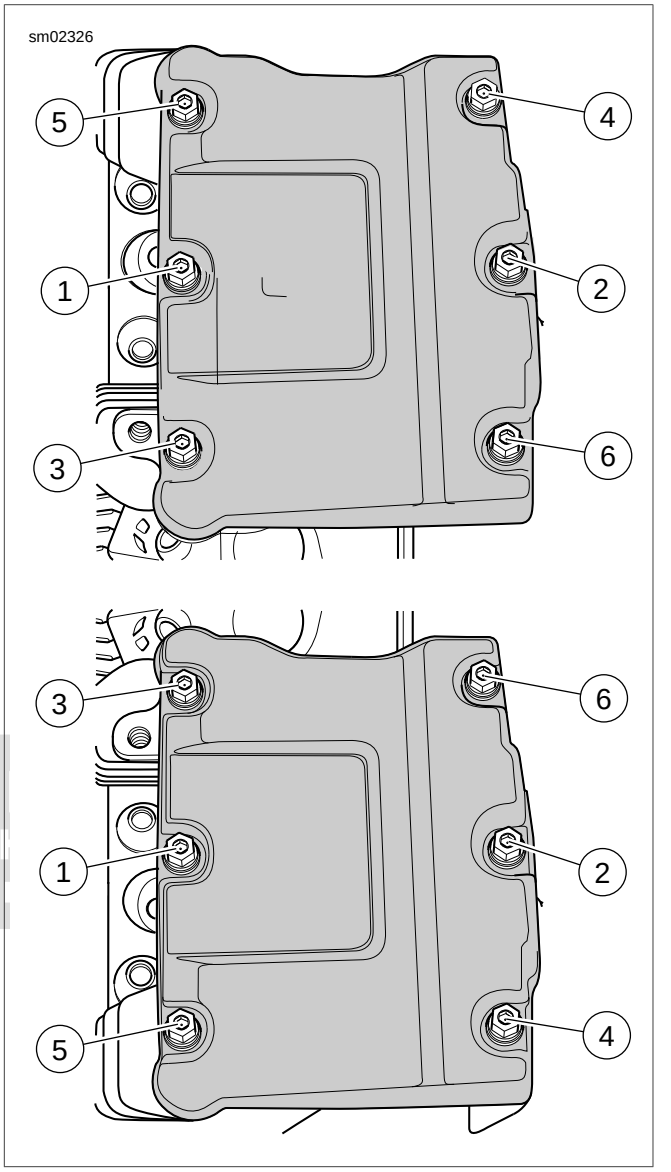
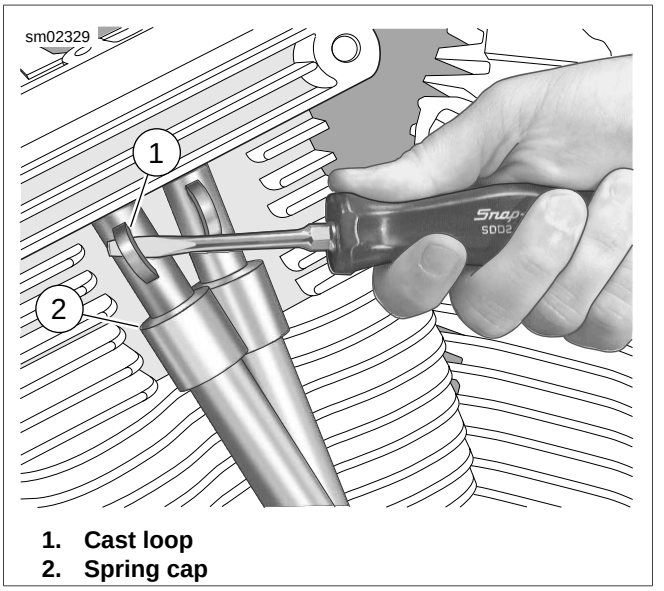


Figure 3-13. Rocker Cover Bolt Removal Sequence

ROCKER ARM SUPPORT PLATE

PART NUMBER	TOOL NAME
HD-48283	CRANKSHAFT ROTATING WRENCH

1. See Figure 3-14. Insert the blade of a small screwdriver into cast loop (1) of spring cap retainer (at top of upper push rod cover). While pushing down on spring cap (2), rotate bottom of screwdriver toward outboard side to remove. Repeat step on second push rod cover.



1. **Cast loop**
2. **Spring cap**

Figure 3-14. Removing Spring Cap Retainer

2. Collapse upper and lower push rod covers.
3. To remove the rocker arm support plate, both lifters of the cylinder being serviced must be on the base circle (lowest position) of the cam. To find the base circle, it is first necessary to rotate the engine. Based on the level of disassembly required, three methods of engine rotation are presented below.
 a. **With primary cover installed -** Remove spark plugs. With the rear wheel raised, place the transmission in 6th gear and rotate rear wheel in a clockwise direction (as viewed from right side) until the base circle is found. Continue with next numbered step.
 b. **With primary cover removed -** Remove spark plugs. Place the transmission in neutral. Fit a socket on the compensating sprocket shaft nut. Rotate nut in a counterclockwise direction until the base circle is found. Continue with step 4.

 NOTE

 Do not attempt to rotate engine by removing cam cover and placing socket on crank or primary cam sprocket flange bolt. Head of flange bolt can break off possibly resulting in damage to flywheel or camshaft.

 c. See Figure 3-15. **With engine mounted in engine stand -** Install CRANKSHAFT ROTATING WRENCH (Part No. HD-48283) on sprocket shaft and rotate in a counterclockwise direction until the base circle is found.

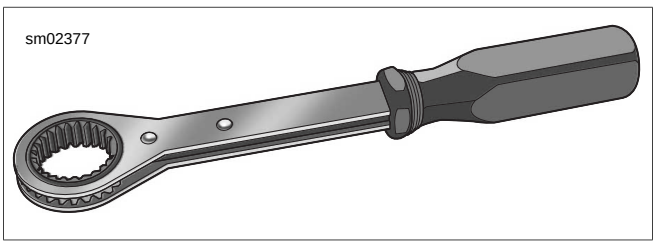


Figure 3-15. Crankshaft Rotating Wrench

4. Using one of the methods above, rotate engine until piston is at top dead center (TDC) of compression stroke.
 a. To accomplish this, first raise lower push rod cover to access intake lifter (inside hole of lifter cover).
 b. Place index finger on top of the intake lifter. While rotating engine, feel lifter rise (valve open) and fall (valve closed).
 c. Now place finger tightly over spark plug hole and rotate engine again. In the compression stroke, air will be forced out against your finger until the piston reaches the TDC position. Stop engine rotation when the flow of air through the spark plug hole stops.
 d. Direct the beam of a small flashlight into spark plug hole to verify piston is at TDC. Both intake and exhaust valves are now closed and the push rods are in the unloaded (loose) position.
5. See Figure 3-16. Remove two bolts to release breather assembly (arrow) and filter element from the rocker arm support plate. For inspection and repair information, see 3.20 BREATHER ASSEMBLY.
6. Alternately loosen each of the four rocker arm support plate bolts 1/4 turn in the pattern shown the figure. Continue turning the bolts in these increments until loose. Remove the rocker arm support plate bolts with flat washers.
7. Remove the rocker arm support plate assembly from the rocker housing. For inspection and repair information, see 3.21 ROCKER ARM SUPPLY PLATE.

NOTE

Always service each cylinder separately. After the first cylinder is serviced the engine must be rotated to find the base circle on the second cam. Service on the remaining cylinder can then proceed.

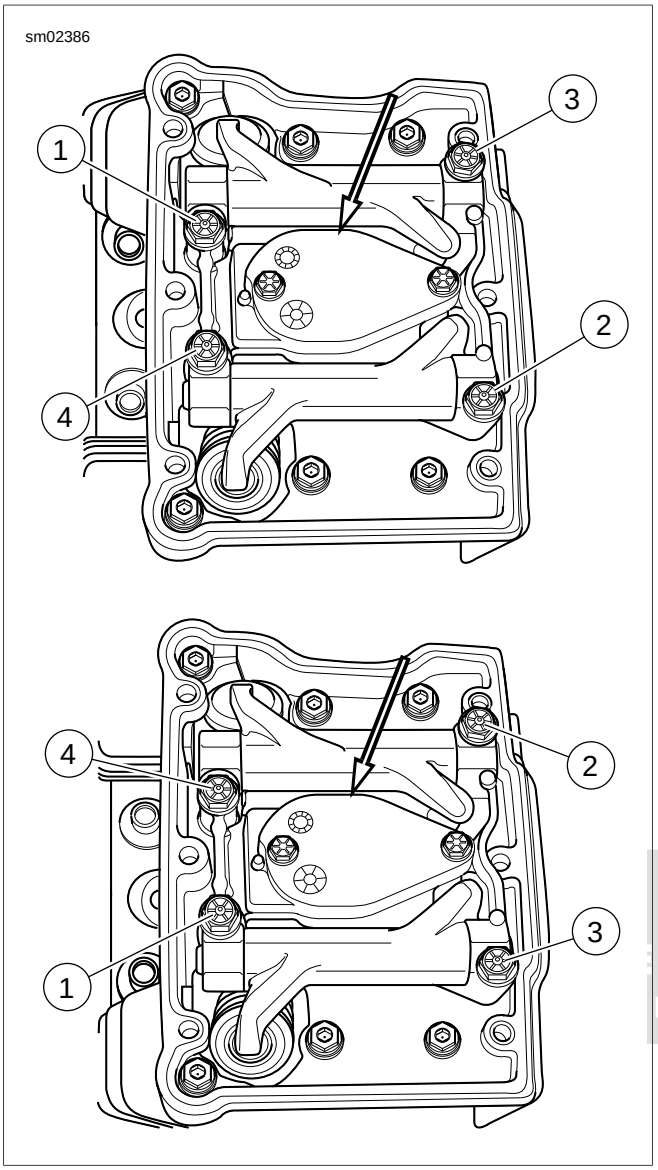
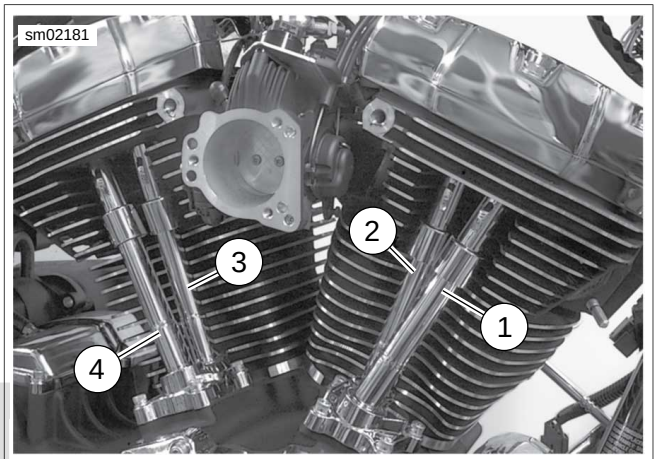


Figure 3-16. 1/4 Turn Rocker Arm Bolts in Sequence

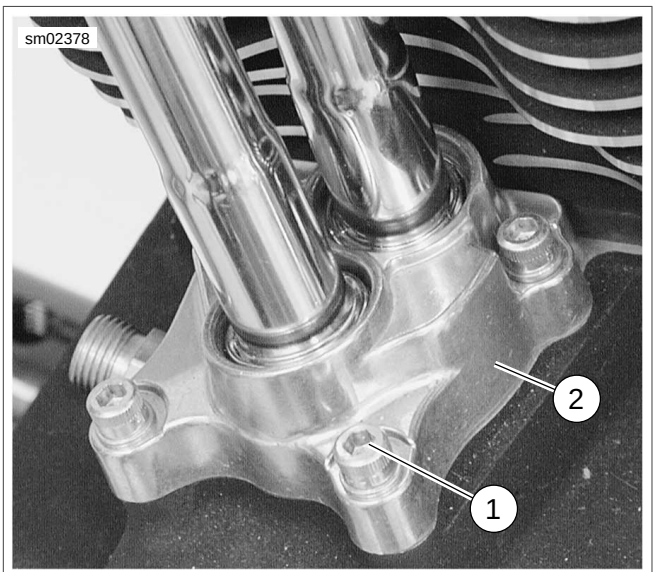
PUSH RODS, LIFTERS AND COVERS

1. See Figure 3-17. Remove the intake and exhaust push rods and push rod covers.
 a. Tag the push rods for location (front/rear cylinder), and orientation (top/bottom) as they are removed. This will simplify installation.
 b. Remove push rod covers from cylinder head and lifter cover bores.
 c. Remove three o-rings from push rod covers and discard. If o-ring is missing from upper push rod cover, be sure to dislodge it from the cylinder head bore.
2. See Figure 3-18. Remove lifter covers.
 a. Using a crosswise pattern, remove four screws with captive washers (1) to release the lifter cover (2).
 b. Remove the lifter cover and gasket. Discard gasket.
3. Remove lifters.
 a. Remove the anti-rotational pin to free the hydraulic lifters.
 b. Tag the lifters for location (front/rear cylinder) and function (intake/exhaust) as they are removed. This will simplify installation.
 c. Place the lifters in clean plastic bags to keep out dust, dirt and debris.
4. See Figure 3-19. Remove and discard o-ring from groove around breather baffle hole in rocker housing.
5. For inspection and repair information, see 3.22 PUSH RODS, LIFTERS AND COVERS.



1. **Front cylinder exhaust push rod**
2. **Front cylinder intake push rod**
3. **Rear cylinder intake push rod**
4. **Rear cylinder exhaust push rod**

Figure 3-17. Push Rod Locations



1. **Screw with captive washer (4)**
2. **Lifter cover**

Figure 3-18. Lifter Cover

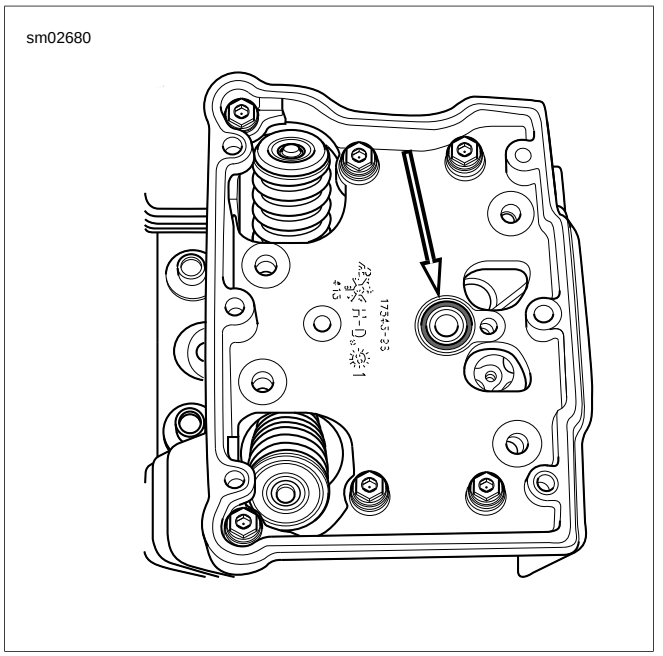


Figure 3-19. Breather Baffle Hole O-Ring

CYLINDER HEAD

PART NUMBER	TOOL NAME
HD-42324-A	CYLINDER TORQUE PLATES

1. See Figure 3-20. Following the sequence shown, alternately loosen the six rocker housing bolts. Remove rocker housing bolts and their captive washers.
2. Remove rocker housing and gasket. Discard gasket.

NOTE

To prevent distortion of the cylinder head, cylinder and cylinder studs, gradually loosen the cylinder head bolts in the specified sequence.

3. See Figure 3-21. Remove cylinder head bolts.
 a. Following the sequence shown, alternately loosen each of the four cylinder head bolts just 1/4 turn.
 b. Continue turning the bolts in these increments until loose.
 c. Remove the cylinder head bolts.
4. Remove cylinder head and head gasket.

NOTE

Save the cylinder head gasket (if salvageable) for use with the CYLINDER TORQUE PLATES (Part No. HD-42324-A) when measuring, boring or honing of the cylinder is required.

5. For inspection and repair information, see 3.23 CYLINDER HEAD.

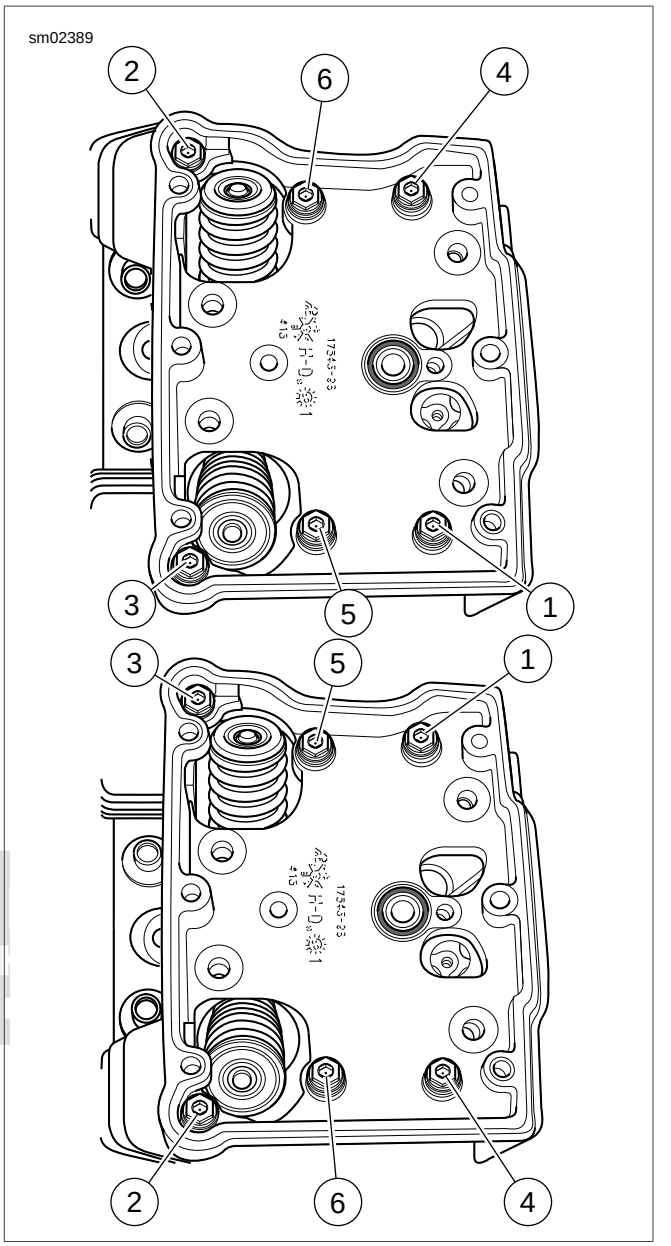


Figure 3-20. Rocker Housing Bolts Removal Sequence

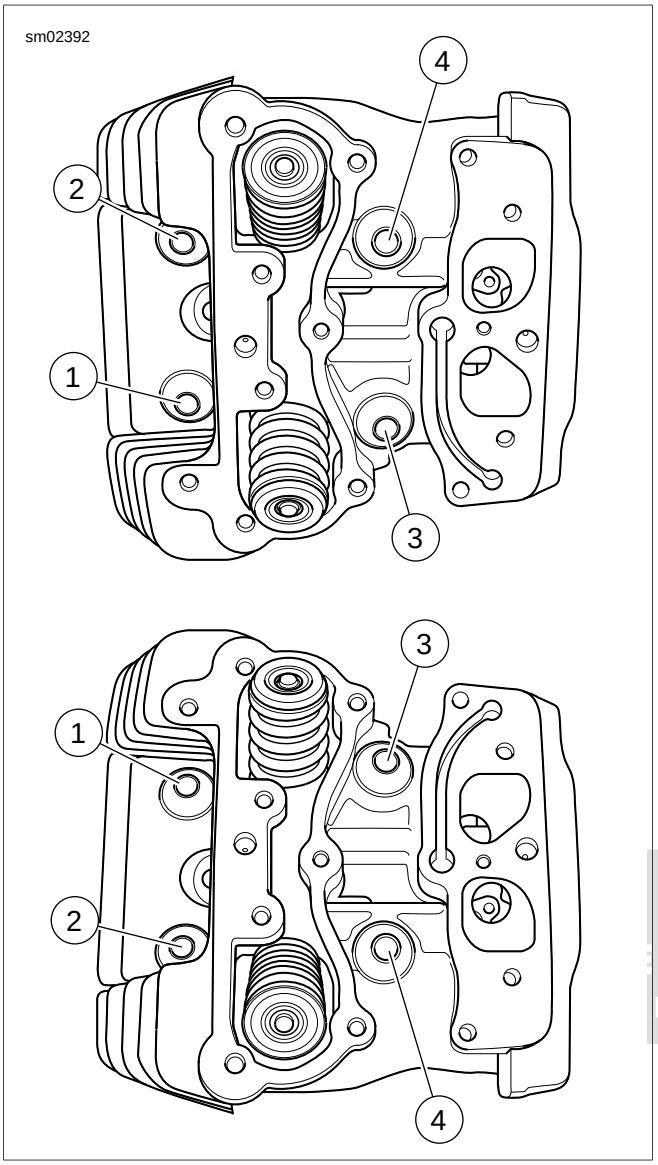


Figure 3-21. 1/4 Turn Head Bolts in Sequence

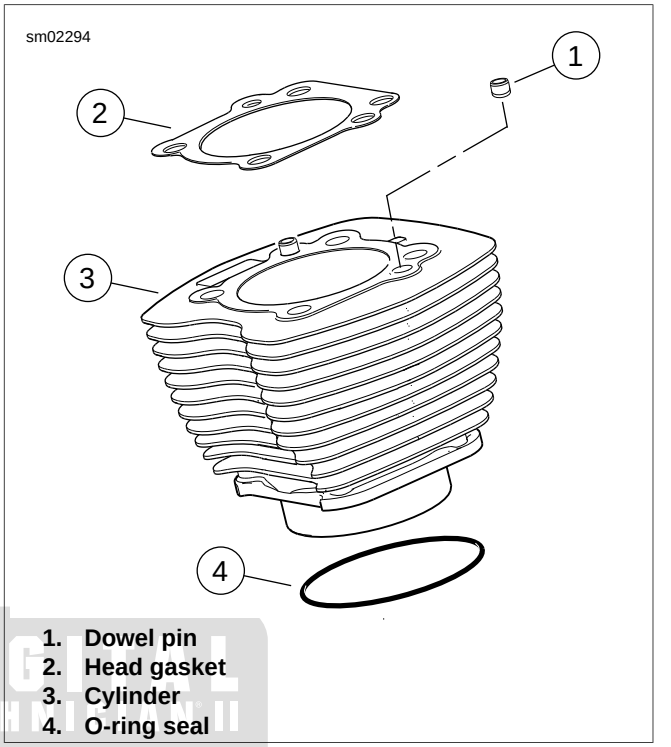
CYLINDER

1. Raise the cylinder just enough to place clean shop towels under the piston. This will prevent any dirt or debris, such as broken ring pieces, from falling into the crankcase bore.

NOTE

Exercise caution to avoid bending the cylinder studs. Even a slight bend or nick can cause a stress riser leading to stud failure.

2. Carefully remove the cylinder. Exercise caution to avoid bending the cylinder studs. As the piston becomes free of the cylinder, hold it upright to prevent it from striking the studs or dragging across the stud thread area.
3. Mark cylinder FRONT or REAR as appropriate.
4. Slide approximately 6.0 in. (152 mm) of plastic tubing, rubber hose or conduit over each cylinder stud. Use material with I.D. of 0.5 in. (12.7 mm) to protect cylinder studs and piston from damage.
5. See Figure 3-22. Remove o-ring seal (4) from the bottom of the cylinder liner. Discard o-ring seal.
6. See Figure 3-23. Remove o-ring from dowel pin (4) on base of cylinder deck. Discard o-ring.
7. For inspection and repair information, see 3.24 CYLINDER.



1. **Dowel pin**
2. **Head gasket**
3. **Cylinder**
4. **O-ring seal**

Figure 3-22. Cylinder Assembly

PISTON

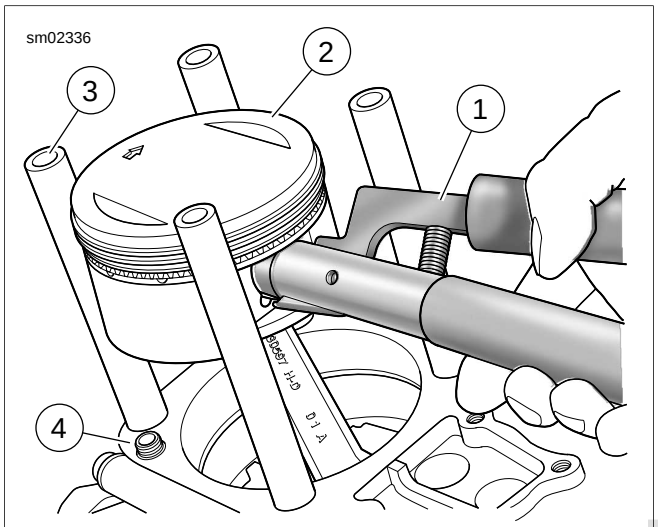
PART NUMBER	TOOL NAME
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER
HD-42320-B	PISTON PIN REMOVER

1. Verify that clean shop towels are properly positioned over the crankcase bore to prevent the piston pin circlip from falling into the crankcase.

⚠WARNING

Wear safety glasses or goggles when removing or installing piston pin retaining rings. Piston pin retaining rings are compressed in the ring groove and can fly out when removed from the groove, which could result in serious eye injury. (00293a)

2. See Figure 3-23. Remove the piston pin circlip.
 a. Insert the PISTON PIN CIRCLIP REMOVER/INSTALLER (Part No. HD-42317-A) (1) into the piston pin bore. Position claw on tool in slot of piston (2) (directly under circlip).
 b. Hold a shop towel over the piston pin bore in case a circlip should fly out during removal. Squeeze the handles of the tool together and pull from bore. Remove circlip from claw and discard.



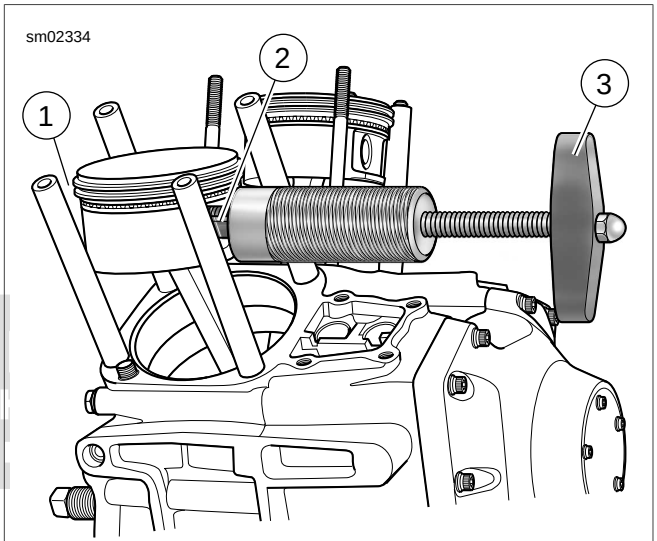
1. **Piston pin circlip remover/installer**
2. **Piston**
3. **Protective material over cylinder studs**
4. **Cylinder deck dowel (O-ring not shown)**

Figure 3-23. Piston Pin Circlip Removal (Part No. HD-42317)

NOTE

It is not necessary to remove both piston pin circlips during piston removal. Leave the second circlip in the pin bore.

3. See Figure 3-24. Remove the piston pin. If piston pin is difficult to remove, use PISTON PIN REMOVER (Part No. HD-42320-B).
 a. Remove acorn nut and spacer from rod end of tool.
 b. Slide rod end through piston pin. Install spacer and acorn nut (1) on end of rod.
 c. Position rubber-coated tips (2) of tool on flat each side of pin bore.
 d. Turn handle (3) in a clockwise direction until piston pin is pulled free of bore.
4. Remove the piston. Be sure to hold the connecting rod shank upright to prevent it from striking the crankcase. Place a 3.0 in. (76.2 mm) long piece of foam-type water pipe insulation around each connecting rod. Use material with an O.D. of 2.25 in. (57.1 mm) and an I.D. of 1.0 in. (25.4 mm) to prevent damage.
5. Turn the piston over. Mark the pin boss with the letters F(ront) or R(ear) to identify location.
6. Service as needed. For inspection and repair information, see 3.25 PISTON.
7. Complete engine work.
 a. If performing a top end overhaul only, see 3.17 TOP END OVERHAUL: ASSEMBLY.
 b. If performing a complete engine overhaul, see 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.



1. **Spacer and acorn nut**
2. **Rubber coated tip**
3. **Handle**

Figure 3-24. Piston Pin Remover (Part No. HD-42320-B)

TOP END OVERHAUL: ASSEMBLY 3.17

GENERAL

NOTES

- *It is assumed that each step performed on one cylinder is automatically repeated on the other.*
- *Do not use 2006 and earlier connecting rods with 2007 and later pistons. 2007 and later pistons have a tapered wrist pin boss. The wrist pin portion of the 2007 and later connecting rod is tapered to match the boss on the piston.*

This section provides a sequential process for engine reassembly after a complete 3.16 TOP END OVERHAUL: DISASSEMBLY. If you reached this section after an inspection or repair procedure, start where necessary and continue to the end of the section.

- Piston installation-see 3.17 TOP END OVERHAUL: ASSEMBLY, Piston.
- Cylinder installation-see 3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder.
- Cylinder head installation-see 3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head.
- Push rods, lifters and covers installation-see 3.17 TOP END OVERHAUL: ASSEMBLY, Push Rods, Lifters and Covers.
- Rocker arm support plate installation-see 3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate.
- Breather assembly installation-see 3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly.

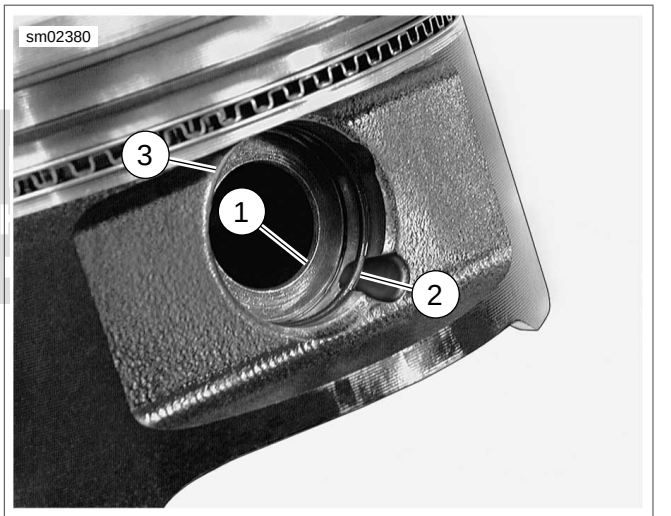
PISTON

PART NUMBER	TOOL NAME
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER

1. Slide approximately 6.0 in. (152 mm) of plastic tubing, rubber hose or conduit over each cylinder stud, if removed. Use material with I.D. of 0.5 in. (12.7 mm) to protect cylinder studs and piston from damage.
2. Apply clean H-D 20W50 engine oil to piston pin, piston bosses and upper connecting rod bushing.
3. Remove water pipe insulation from connecting rod shank.
4. See Figure 3-25. Place piston over rod end so that the arrow stamped at the top of the piston points toward the front of the engine.
5. See Figure 3-26. Insert piston pin (1) through pin bore and upper connecting rod bushing. Push pin until it contacts circlip installed in opposite pin boss. Verify that end gap (3) for circlip is 180 degrees from opening (2).
6. Place clean shop towels over the cylinder and lifter bores to prevent the piston pin circlip from falling into the crankcase. Verify that the circlip groove is clean and free of dirt and grime.



Figure 3-25. Piston Installation Arrow



1. **Piston pin**
2. **Circlip opening**
3. **End gap location**

Figure 3-26. Preinstalled Circlip

NOTE

Do not reuse piston pin circlips. The circlips could weaken during removal causing them to break or dislodge during engine operation, a condition that will result in engine damage.

7. Install **new** piston pin circlip with the PISTON PIN CIRCLIP REMOVER/INSTALLER (Part No. HD-42317-A).
 a. See Figure 3-27. Slide circlip down nose of tool until it contacts claw. Lightly squeeze handles of tool to capture circlip in claw.
 b. Releasing pressure on handles, rotate circlip so that the end gap is centered at top of tool and then recapture in claw.
 c. Tilt the circlip forward until the end gap contacts nose of tool.
 d. See Figure 3-28. Insert the tool (1) into the piston pin bore until claw is aligned with slot (2) in piston.
 e. Firmly push the tool into the piston pin bore until it bottoms. Release handles and remove tool.
 f. Inspect the circlip to verify that it is fully seated in the groove.

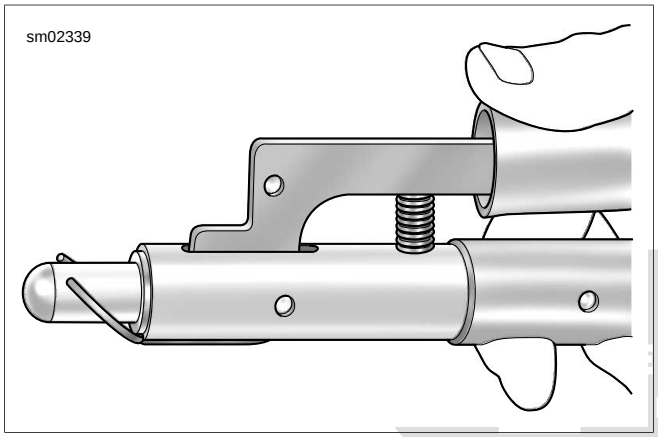
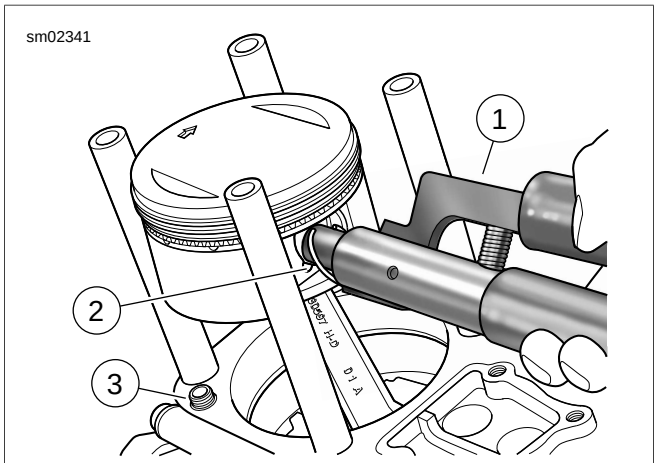


Figure 3-27. Aligning Circlip



1. **Piston pin circlip remover/installer**
2. **Slot**
3. **Cylinder deck dowel (O-ring not shown)**

Figure 3-28. Pin Circlip Remover/Installer (Part No. HD-42317)

CYLINDER

PART NUMBER	TOOL NAME
HD-42322	PISTON SUPPORT PLATE
HD-95952-1	THREADED CYLINDERS
HD-95952-33C	CONNECTING ROD CLAMPING TOOL
HD-96333-51F	PISTON RING COMPRESSOR

NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings, keeping them packaged until use to avoid confusion.*

1. See Figure 3-28. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-rings for both lower cylinder deck dowels. Install and verify that o-ring is properly seated in groove.
2. See Figure 3-29. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring seal for the bottom of the cylinder liner. Install **new** o-ring seal.

NOTE

Excessive lubrication of cylinder sleeve o-ring seal will result in oil weepage between cylinder and crankcase as engine is run. This condition may be incorrectly diagnosed as an oil leak.

3. See Figure 3-30. Verify that the piston ring end gaps are staggered. Rotate each ring to position the gap 90 to 180 degrees from the gap in the ring above it. Locate the top piston ring (5) gap towards the intake port.
4. Apply clean H-D 20W50 engine oil to piston, piston rings and cylinder bore.
5. Remove protective covers from cylinder studs. Rotate engine until piston is at top dead center. If necessary, see 3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate for three methods of engine rotation.
6. See Figure 3-31. Install the PISTON SUPPORT PLATE (Part No. HD-42322).
 a. Slide both adjustable knobs (2) on support plate (1) down away from forked end. Tighten knobs when contact is made with flats at end of slots.
 b. With the forked end of the tool pointing towards the center of the engine and the adjustable knobs facing downward, capture shank of connecting rod in fork. Lay tool on cylinder deck so that adjustable knobs contact wall of cylinder bore.
 c. Rotate engine until piston skirt is centered and firmly seated on top of support plate.

7. See Figure 3-32. Install cylinder using PISTON RING COMPRESSOR (Part No. HD-96333-51F).
 a. Fit tabs on pliers (1) into slots of ring compressor band (2). The arrow stamped on the band indicates the side that faces up, so disregard the word "bottom". Place band around piston. Press the lever on the right side of the pliers to open the jaws for band expansion.
 b. Orient tool so that the top of the band is positioned between the top compression ring and the piston crown. Tightly squeeze handles of tool to compress piston rings. The ratcheting action of the tool allows release of the handles after the rings are compressed.
 c. With the indent in the cooling fins facing the right side of the engine, gently slide cylinder over the cylinder studs and the piston crown resting it on the top of the ring compressor band.
 d. Place the palms of both hands at the top of the cylinder. Push down on the cylinder with a sharp, quick motion to pass the piston ring area.
 e. Rotate the engine slightly to raise piston off support plate. Remove pliers from band and then remove band from around shank of connecting rod. Remove piston support plate.
8. Remove shop towels from around the crankcase bore exercising caution to keep out any dirt or debris.
9. Carefully set the cylinder over the two dowel pins in the cylinder deck. Push down on the cylinder until it is fully seated in the crankcase bore.

NOTE

See Figure 3-33. To hold the first cylinder in position while installing the second, install THREADED CYLINDERS (Part No. HD-95952-1) from CONNECTING ROD CLAMPING TOOL (Part No. HD-95952-33C) onto cylinder studs with the knurled side down. This will prevent the piston rings from raising the cylinder as the engine is rotated to bring the other piston into position for installation of the second cylinder.

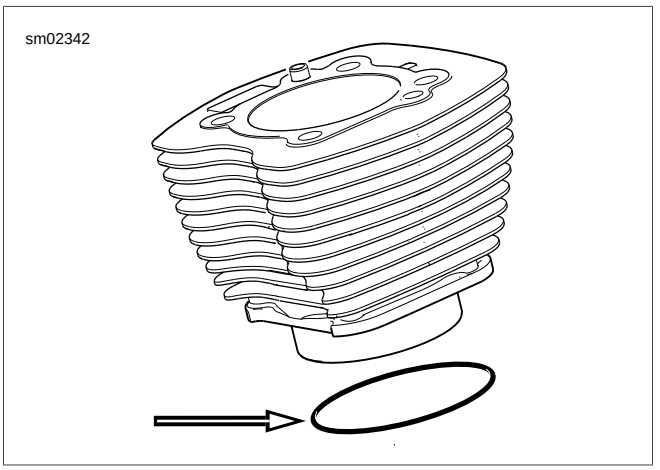
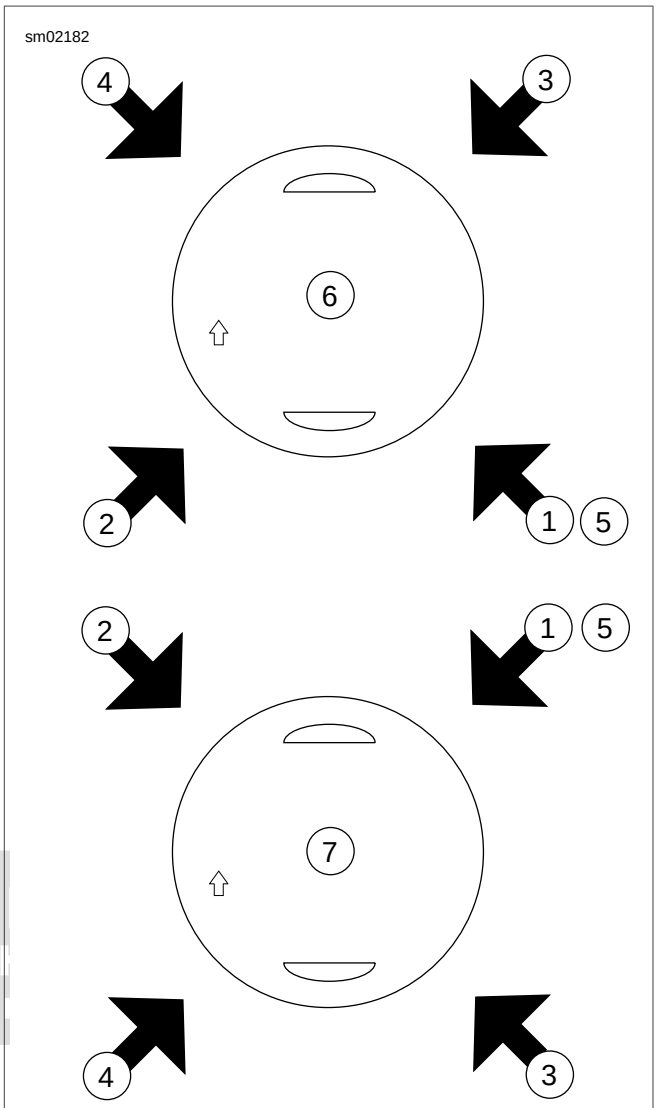
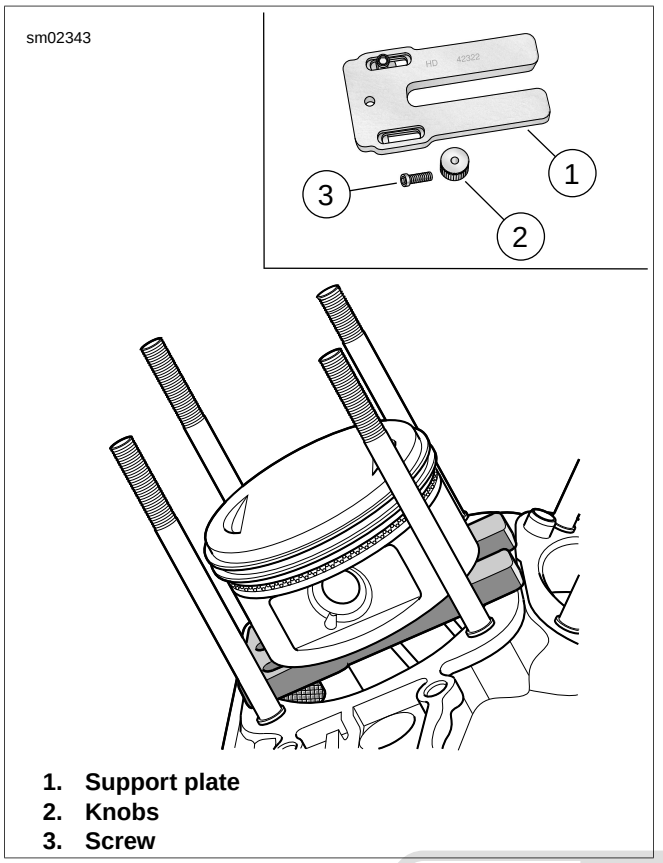


Figure 3-29. O-ring Seal For Cylinder



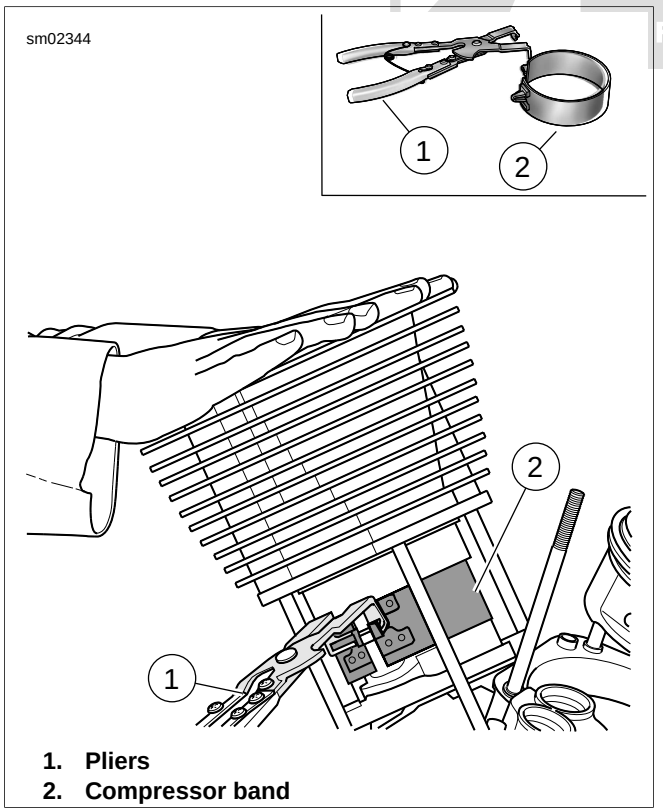
1. **Expander spring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**
6. **Front**
7. **Rear**

Figure 3-30. Piston Ring Alignment



1. **Support plate**
2. **Knobs**
3. **Screw**

Figure 3-31. Piston Support Plate



1. **Pliers**
2. **Compressor band**

Figure 3-32. Piston Ring Compressor

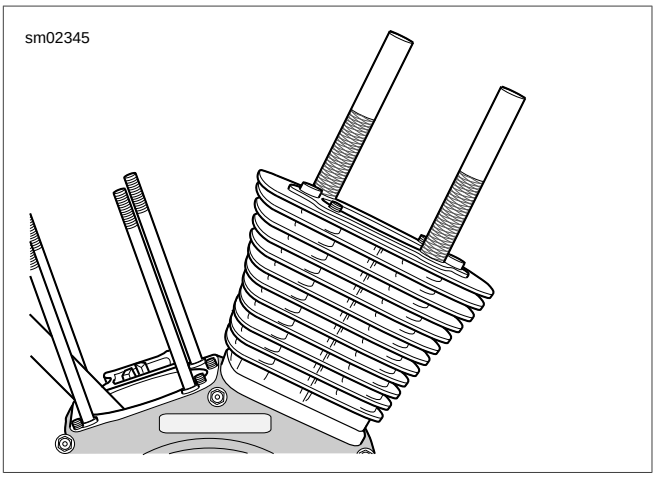


Figure 3-33. Install Threaded Cylinders to Studs

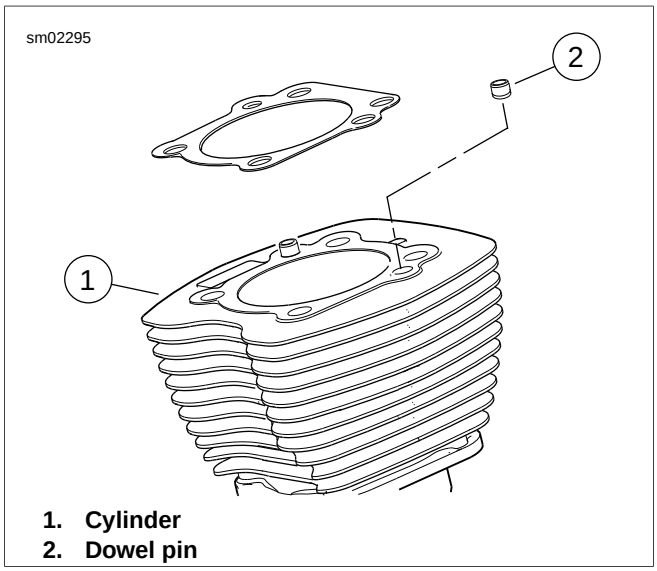
CYLINDER HEAD

1. See Figure 3-34. With the part number face up, place the head gasket over the two dowel pins in the upper flange of the cylinder.
2. Note that the word "Front" or "Rear" is cast into the top of the cylinder head to verify proper installation. With the indent in the cooling fins facing the right side of the engine, gently slide cylinder head over the two cylinder flange dowel pins. Lower the cylinder head at an angle that closely approximates the angle of the crankcase to avoid damage to machined surfaces or the dowel pins.

NOTE

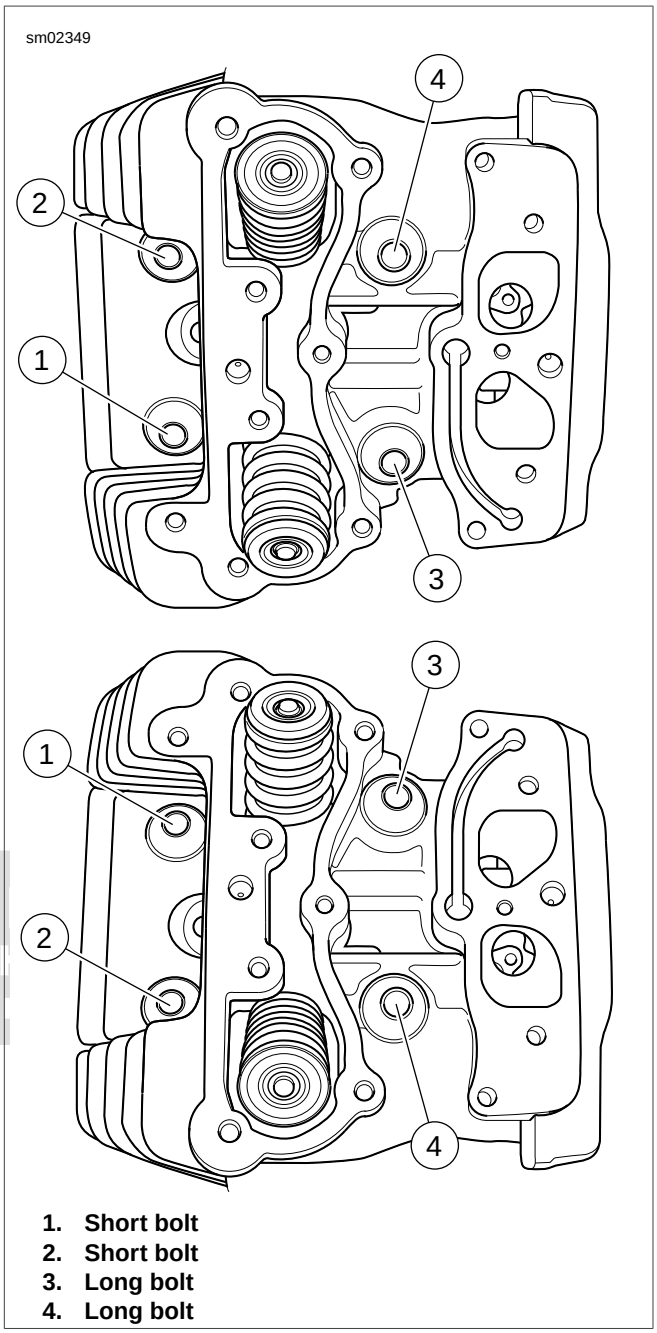
Thoroughly clean and lubricate the threads of the cylinder head bolts before installation. Friction caused by dirt and grime will result in a false torque indication.

3. Lightly coat the threads and bottom face of the cylinder head bolts in clean H-D 20W50 engine oil. Wipe off any excess oil.
4. See Figure 3-35. Loosely install the cylinder head bolts onto the cylinder studs. Place two short bolts on the left side of the engine and two long bolts on the right.



1. **Cylinder**
2. **Dowel pin**

Figure 3-34. Cylinder Dowel Pins



1. **Short bolt**
2. **Short bolt**
3. **Long bolt**
4. **Long bolt**

Figure 3-35. Cylinder Head Bolt Torque Sequence (Top: Front Cylinder Head, Bottom: Rear Cylinder Head)

NOTE

Improperly tightened cylinder head bolts may result in gasket leaks, stud failure and distortion of the cylinder and/or cylinder head.

5. Tighten the four cylinder head bolts.
 a. Following sequence shown, alternately turn each cylinder head bolt until finger tight.
 b. Following the same sequence, tighten the cylinder head bolts to 120-144 **in-lbs** (13.5-16.2 Nm).
 c. Continuing the same sequence, tighten each bolt to 15-17 ft-lbs (20.3-23.0 Nm).
 d. See Figure 3-36. Using a grease pencil, mark a straight line on the cylinder head bolt continuing the line over onto the cylinder head.
 e. Using the marks as a guide, turn each bolt 1/4 turn or 90 degrees. Be sure to tighten the cylinder head bolts in the sequence shown in Figure 3-35.

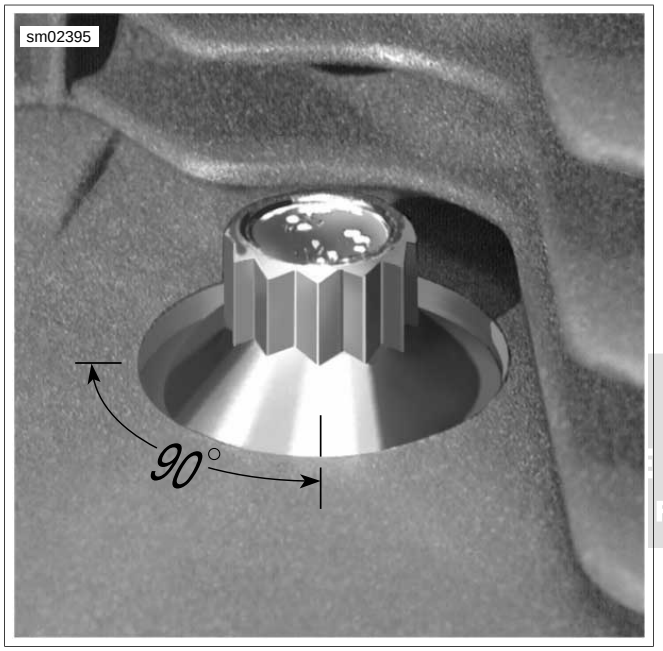


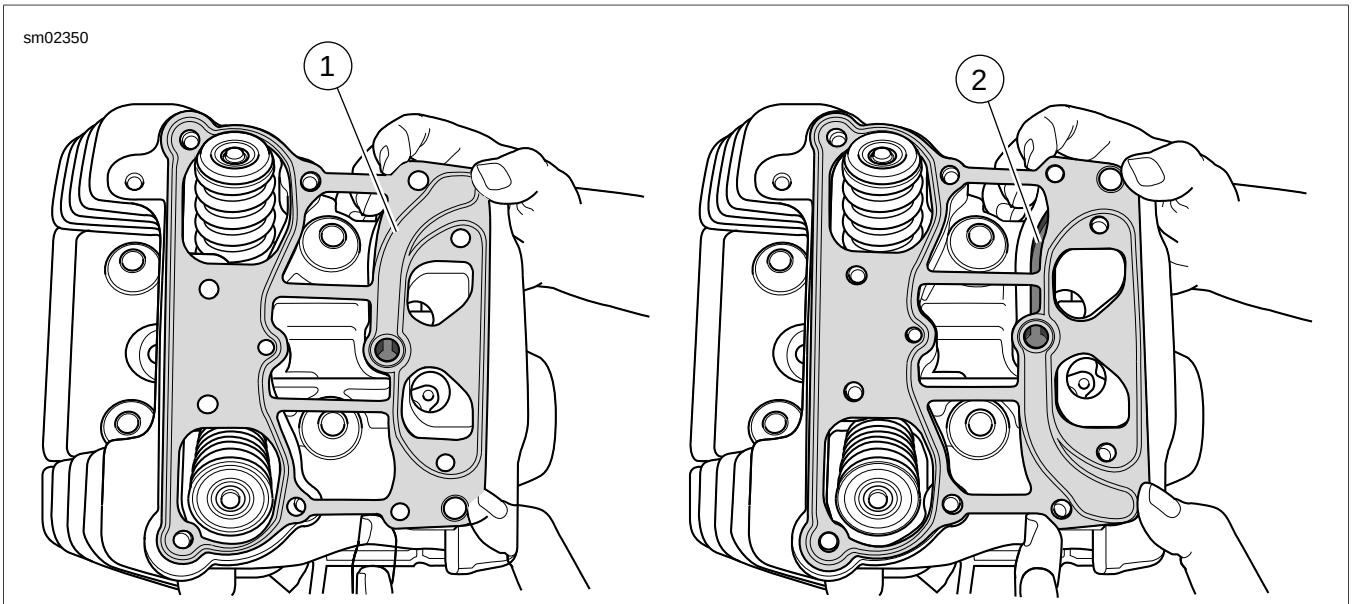
Figure 3-36. Final Tightening for Cylinder Head Bolts

NOTES

- *For best results, use SNAP-ON TORQUE ANGLE GAUGE TA360.*
- *Even though all bolt holes (rocker housing, rocker arm support plate and breather assembly) may appear to be in alignment, the rocker housing gasket may be installed upside down. An upside down gasket will result in an open breather channel causing a major oil leak when the vehicle is started, possibly resulting in engine and/or property damage.*
- *On front cylinder head, install side of gasket marked "front" facing up. On rear cylinder head, install side of gasket marked "rear" facing up.*

6. See Figure 3-37. Install a **new** rocker housing gasket on the cylinder head. Verify that the rocker housing gasket covers the breather channel.

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1. **CORRECT: Breather channel covered**
2. **INCORRECT: Breather channel exposed**

Figure 3-37. Install Rocker Housing Gasket (Rear Cylinder Shown)

7. See Figure 3-39. With the indent (1) facing forward, place the rocker housing into position aligning the holes in the housing with those in the gasket.
8. See Figure 3-38. Apply a small dab of LOCTITE THREADLOCKER 243 (blue) to threads of six rocker housing bolts. Loosely install the rocker housing bolts. Place two long bolts on the left side of the engine and four intermediate bolts in the interior. Alternately tighten the bolts to 120-168 **in-lbs** (13.6-19.0 Nm) in the sequence shown.

NOTES

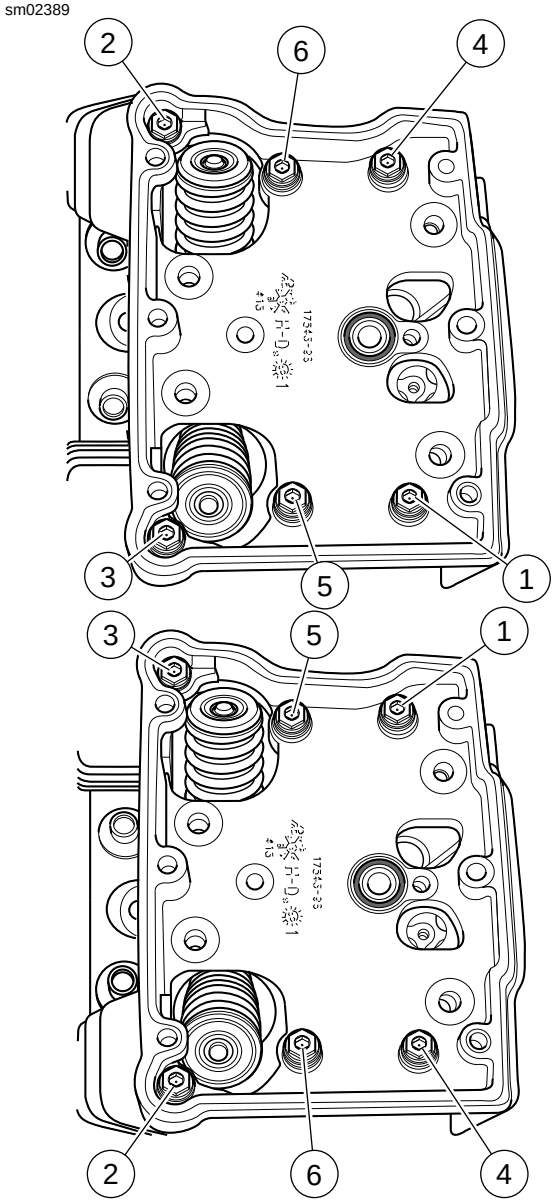
- *If the engine was left in the chassis for service, final tighten the rear left rocker housing bolt (rear cylinder) using a torque wrench with a 1/4 in. drive.*
- *O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings, keeping them packaged until use to avoid confusion.*

9. See Figure 3-39. Apply a very thin film of clean H-D 20W50 engine oil to **new** baffle hole o-ring (2). Install **new** o-ring in groove around breather baffle hole in rocker housing.

NOTE

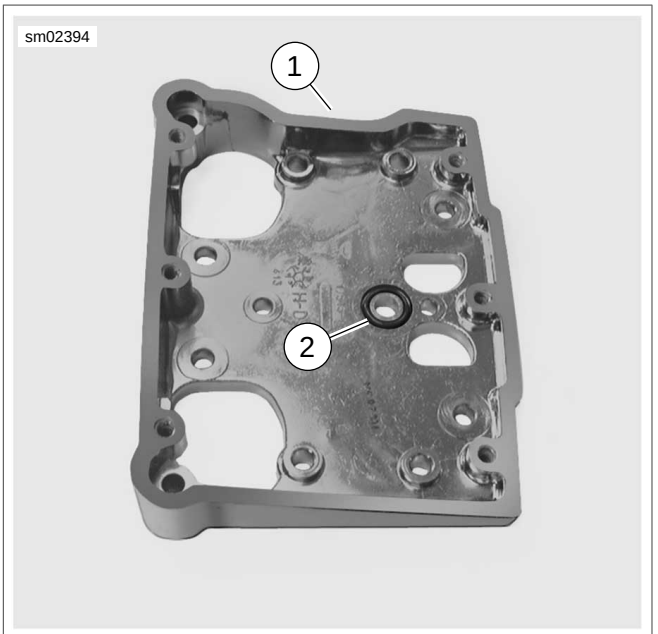
Do not confuse breather baffle hole o-ring (Part No. 11270, large inner diameter) with the top push rod o-ring (Part No. 11293, small inner diameter).

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1. **Short bolt, 1.25 in. (31.8 mm)**
2. **Long bolt, 1.75 in. (44.5 mm)**
3. **Long bolt, 1.75 in. (44.5 mm)**
4. **Short bolt, 1.25 in. (31.8 mm)**
5. **Short bolt, 1.25 in. (31.8 mm)**
6. **Short bolt, 1.25 in. (31.8 mm)**

Figure 3-38. Rocker Housing Torque Sequence and Bolt Size



1. **Indent**
2. **Breather baffle hole O-ring**

Figure 3-39. Rocker Housing Alignment

PUSH RODS, LIFTERS AND COVERS

1. Remove any labels used on the hydraulic lifters. Install lifters in the crankcase bores with the oil hole on the inboard side and the flats on the lifters facing forward and rearward. To avoid damage, do not drop lifters onto cam lobes.
2. See Figure 3-40. Place the anti-rotational pin (4) on the machined flat between the blocks cast into the crankcase.
3. Install a **new** lifter cover gasket (2) aligning the holes in the gasket with those in the cover (1).

NOTE

Movement or loss of the pin can result in lifter rotation causing engine damage.

4. Install the lifter cover and start the four allen head socket screws (1/4 x 1.0 in). During installation, verify that the anti-rotational pin (4) is held in place by the ribs (3) cast into the inboard side of the lifter cover. Tighten the lifter cover screws to 90-120 **in-lbs** (10.2-13.6 Nm) in a cross-wise pattern.
5. Install push rod covers.
 a. Hand compress the push rod cover assembly and fit the o-ring end of the lower push rod cover into the lifter cover bore.
 b. Extending the assembly, fit the o-ring end of the upper push rod cover into the cylinder head bore.
 c. Do not install the spring cap retainers at this time.

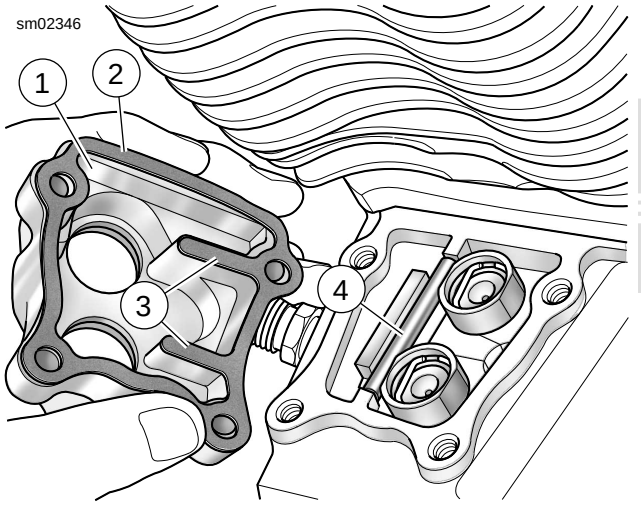
NOTE

To install spring cap retainers, see 3.17 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate.

6. Refer to Table 3-32. Install the push rods in their original positions. Be sure to remove any tags that may have been used for identification.
 a. See Figure 3-41. For example, if reassembling the rear cylinder, slide the intake push rod (silver) through the front hole in the rocker housing engaging the lifter socket in the inside hole of the lifter cover.
 b. Slide the exhaust push rod (black) through the rear hole in the rocker housing engaging the lifter socket in the outside hole of the lifter cover.

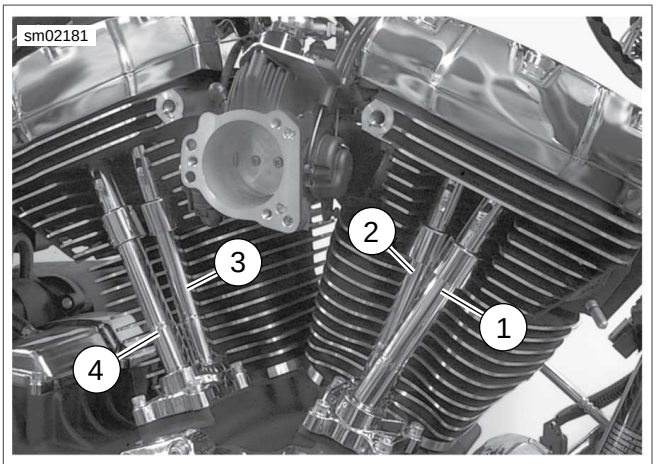
Table 3-32. Push Rod/Lifter Locations

CYL-INDER	COVER & PUSH ROD	LIFTER BORE COVER	CYLINDER HEAD/ROCKER HOUSING BORE
Front	Intake	Inside	Rear
	Exhaust	Outside	Front
Rear	Intake	Inside	Front
	Exhaust	Outside	Rear



1. **Cover**
2. **Gasket**
3. **Ribs on cover**
4. **Anti-rotational pin**

Figure 3-40. Installing Lifters



1. **Front cylinder exhaust push rod**
2. **Front cylinder intake push rod**
3. **Rear cylinder intake push rod**
4. **Rear cylinder exhaust push rod**

Figure 3-41. Push Rod Locations

ROCKER ARM SUPPORT PLATE

Installing the rocker arms and rotating the engine with the valve train loaded can result in bent push rods, damaged bushings or a warped support plate.

1. To install the rocker arm support plate, both lifters of the cylinder being serviced must be on the base circle (or lowest position) of the cam. To rotate engine, see 3.17 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate.
2. See Figure 3-42. Place the rocker arm support plate assembly into the rocker housing. Loosely install the four rocker arm support plate bolts with flat washers.

NOTE

If the engine was left in the chassis for service, final tighten the rocker arm support plate bolt on the rear left side of the rear cylinder using a 3/8 in. drive torque wrench with a 1/2 in. flank drive "dog bone" torque adapter (Snap-on FRDH161). Failure to properly use this combination will overtighten the bolts causing distortion of the rocker housing.

3. Tighten rocker arm support plate bolts.
 a. Following the sequence shown, alternately tighten each of the four rocker arm support plate bolts just 1/4 turn. Continue turning the bolts in these increments until snug.
 b. Following the same sequence, tighten the bolts to 18-22 ft-lbs (24.4-29.8 Nm).
4. Lift up lower push rod covers and verify that both push rods spin freely.

NOTE

Always service each cylinder separately. After the first cylinder is serviced the engine must be rotated to find the base circle on the second cam. Service on the remaining cylinder can then proceed.

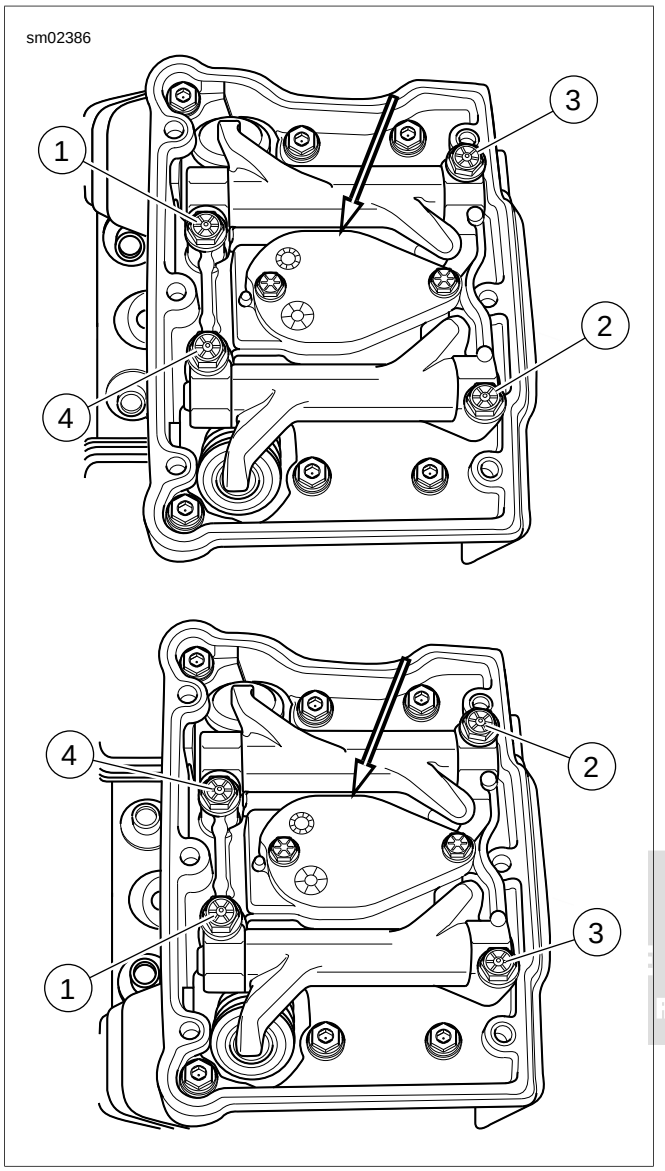


Figure 3-42. Rocker Arm Torque Sequence

5. Complete installation of the push rod covers.
 a. Verify that the o-ring ends of the upper and lower push rod covers fit snugly into the cylinder head and lifter cover bores.
 b. Insert the upper edge of spring cap retainer into the cylinder head bore leaving the bottom edge free.
 c. Insert blade of small screwdriver between bottom edge of spring cap retainer and top of spring cap.

NOTE

For best results, be sure that screwdriver, spring cap and spring cap retainer are free of grease and oil.

 d. See Figure 3-43. While simultaneously depressing spring cap with tip of screwdriver, use forefinger to slide bottom edge of spring cap retainer down shaft towards tip of screwdriver blade. As spring cap reaches its full length of travel, spring cap retainer should be in approximate position against upper push rod cover.
 e. Verify that spring cap retainer is seated tightly against upper push rod cover.



Figure 3-43. Install Spring Cap Retainers

BREATHER ASSEMBLY

NOTE

For breather assembly service procedures, see 3.20 BREATHER ASSEMBLY.

1. See Figure 3-45. Alternately tighten the two bolts to secure breather assembly to 90-120 **in-lbs** (10.2-13.6 Nm).
2. See Figure 3-44. Install a **new** rocker cover gasket with indent facing forward on the rocker housing flange. Place the rocker cover into position aligning the holes in the cover with those in the gasket.

NOTE

If the engine was left in the chassis for service, final tighten the three rocker cover bolts on the left side of the rear cylinder using a 3/8 in. drive torque wrench with a 7/16 in. flank drive "dog bone" torque adapter (Snap-on FRDH141). Failure to properly use this combination will overtighten the bolts causing distortion of the rocker cover.

3. See Figure 3-45. Install rocker cover bolts.
 a. Apply a small dab of LOCTITE THREADLOCKER 243 (blue) to threads of six rocker cover bolts.
 b. Loosely install bolts in the rocker cover.
 c. Following the sequence shown, tighten bolts to 15-18 ft-lbs (20.3-24.4 Nm).
4. Complete motorcycle assembly.
 a. If engine was left in the chassis for service, see 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE.
 b. If engine was removed for service, see 3.15 INSTALLING ENGINE IN CHASSIS.

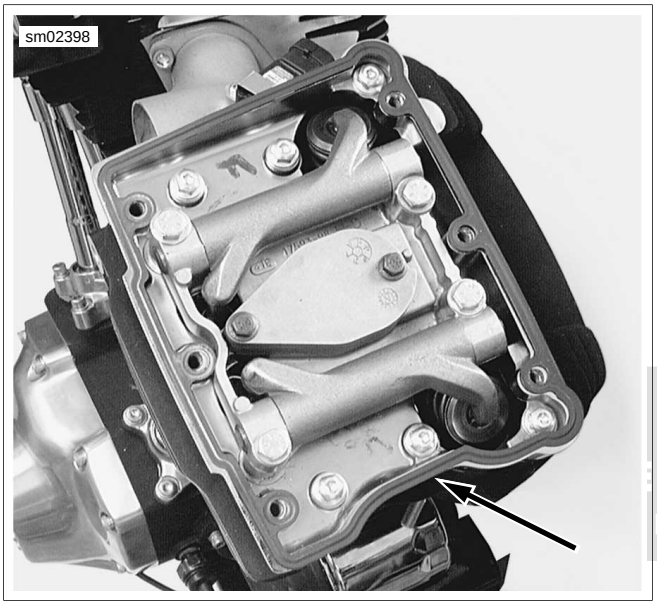
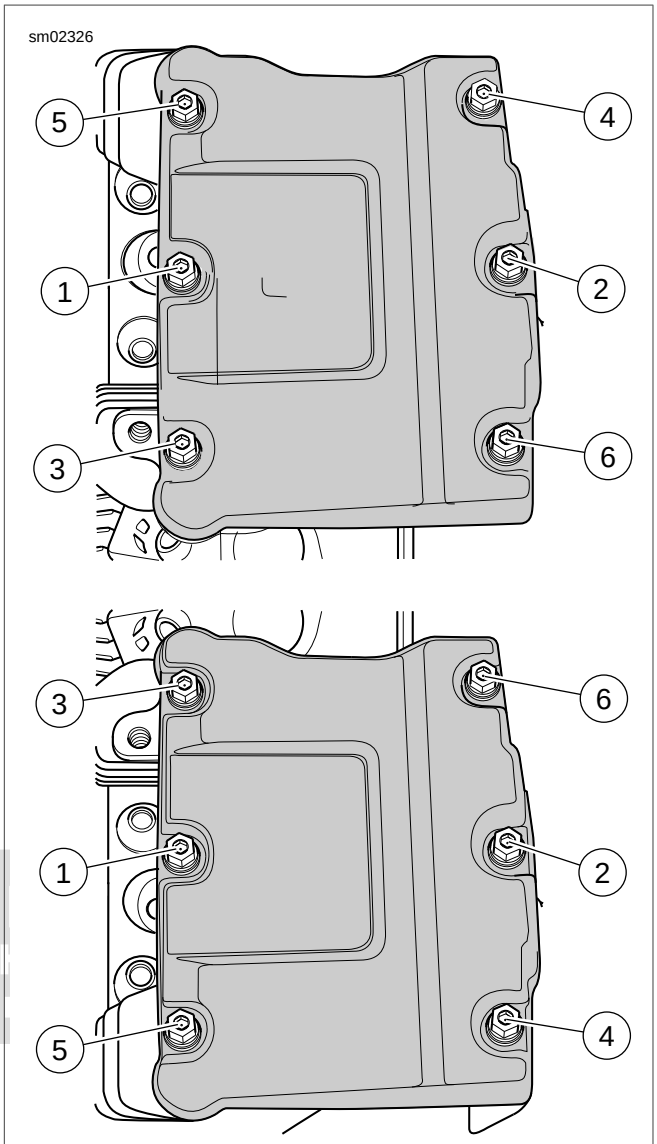


Figure 3-44. Rocker Cover Gasket Indent (Front Cylinder Shown)



1. **Short bolt, 1.0 in. (25.4 mm)**
2. **Long bolt, 1.75 in. (44.5 mm)**
3. **Short bolt, 1.0 in. (25.4 mm)**
4. **Long bolt, 1.75 in. (44.5 mm)**
5. **Short bolt, 1.0 in. (25.4 mm)**
6. **Long bolt, 1.75 in. (44.5 mm)**

Figure 3-45. Rocker Cover Bolts Torque Sequence

BOTTOM END OVERHAUL: DISASSEMBLY 3.18

GENERAL

To perform a complete bottom end overhaul, follow all steps listed in this section including inspection and repair procedures.

CAM SUPPORT PLATE AND COVER

PART NUMBER	TOOL NAME
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL

Prepare Engine

1. If performing a complete engine overhaul, perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.
2. If only servicing cam compartment components, partial top end disassembly is required. Remove breather assembly, rocker arm support plate, push rods and push rod covers. Do not remove lifters. See appropriate topics under 3.16 TOP END OVERHAUL: DISASSEMBLY.
3. Support lifters using improvised tool as described under 3.26 CAM SUPPORT PLATE AND COVER.
4. See Figure 3-46. Remove the ten allen head socket screws with captive washers to release the cam cover. Remove and discard the cam cover gasket.

NOTE

The cam support plate, lifter cover and crankshaft position sensor mount all use the same short allen head socket screw (1/4 x 1 in.). Only the cam cover uses the longer screw (1/4 x 1-1/4 in.). For ease of assembly, do not mix the short and long screws. Store the long screws inside the cam cover to avoid confusion. The short screws are interchangeable.

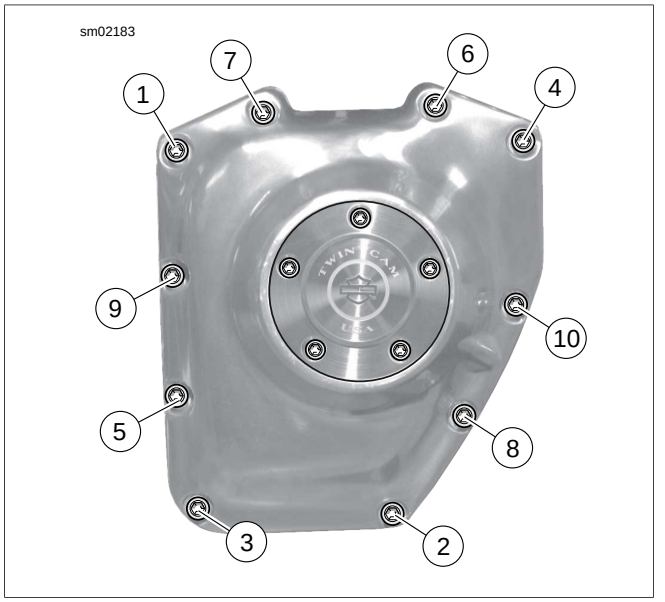


Figure 3-46. Cam Cover Screws

Cam Chain and Sprockets

1. See Figure 3-47. Using a colored marker, mark one of the links (1) of the primary cam chain. Maintaining the original direction of rotation during assembly may prolong service life.

WARNING

Be sure to follow manufacturer's instructions when using propane torches. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00465c)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

NOTE

A piece of wire can be inserted into retention hole (6) to keep cam chain tensioner components assembled.

2. Remove primary cam chain tensioner fasteners (4) and primary cam chain tensioner (3).

NOTE

In next step, be sure side of tool labeled "crank side" faces crank sprocket.

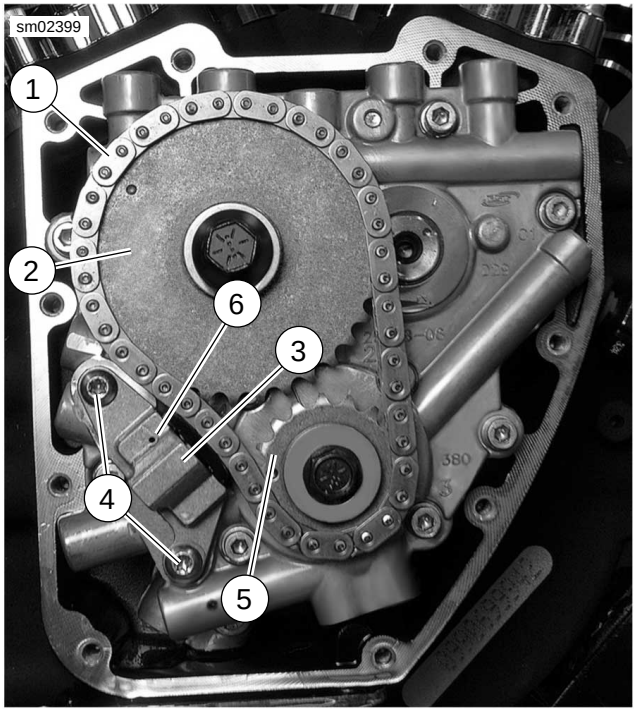
3. See Figure 3-48. Install CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between cam sprocket (2) and crank sprocket (5).

NOTES

- *Only use approved methods for removing rear cam bolt. Other methods of removal, such as the use of a large breaker bar, may result in damage to chain drive and other components.*
- *If too much LOCTITE or perhaps the wrong LOCTITE was used to install the rear cam bolt, it may be very difficult to remove. In these cases, break down LOCTITE by using heat from a small propane torch. Apply flame evenly around bolt in a circular motion, but not for so long as to turn bolt blue.*

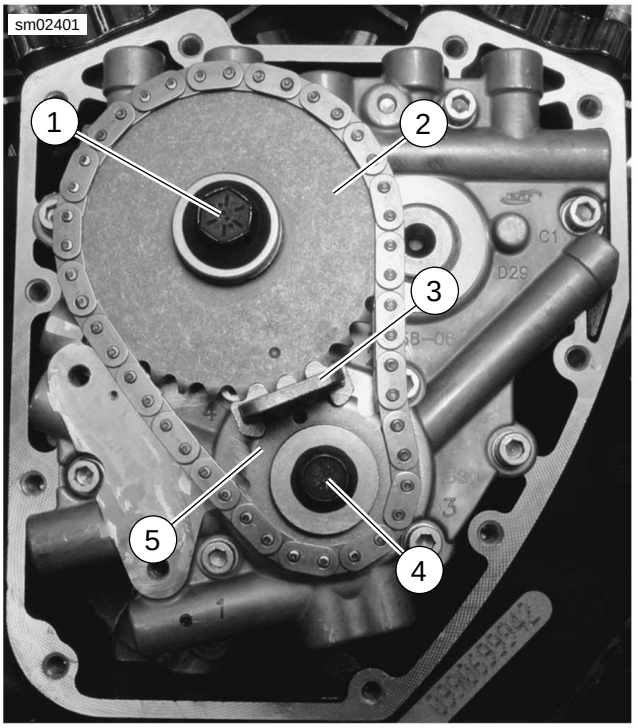
4. Remove the rear cam sprocket bolt and flat washer (1) from the rear cam sprocket (2).
5. Remove the crank sprocket bolt and flat washer (4) from the crank sprocket (5).
6. Remove CAMSHAFT LOCKING TOOL.
7. Insert small pry bar (seal remover) between inboard side of rear cam sprocket and cam support plate. Working around its circumference, carefully ease off rear cam sprocket until loose on camshaft.

8. Ease off crank sprocket with a slightly smaller pry bar (seal remover). Remove the rear cam sprocket, primary cam chain and crank sprocket.



1. **Link**
2. **Rear cam sprocket**
3. **Primary cam chain tensioner**
4. **Primary cam chain tensioner fasteners**
5. **Crank sprocket**
6. **Retention hole**

Figure 3-47. Cam Support Plate Assembly



1. **Rear cam sprocket bolt (large) and flat washer**
2. **Rear cam sprocket**
3. **Camshaft locking tool (HD-47941)**
4. **Crank sprocket bolt (small) and flat washer**
5. **Crank sprocket**

Figure 3-48. Cam Support Plate Assembly

Cam Support Plate

1. See Figure 3-49. Following the sequence shown, alternately loosen and then remove the four allen head socket screws with captive washers to release the cam support plate from the oil pump flange.
2. See Figure 3-50. Following the sequence shown, alternately loosen and then remove the six allen head socket screws with captive washers to release the cam support plate from the crankcase flange.

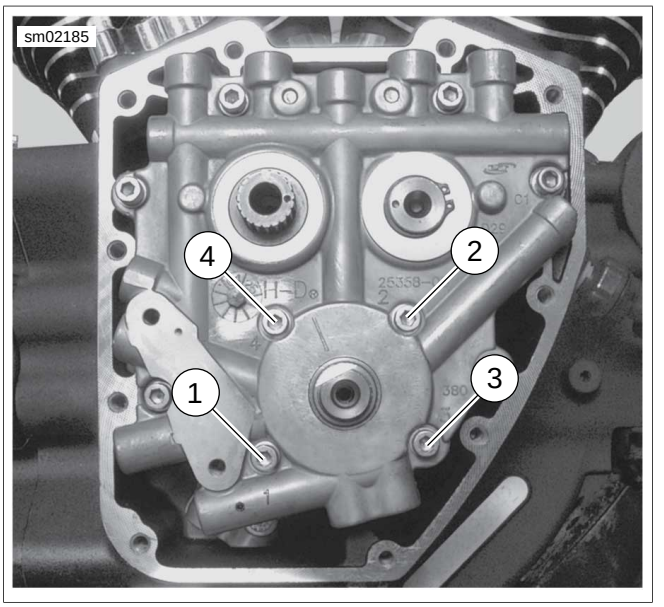


Figure 3-49. Oil Pump Torque Sequence

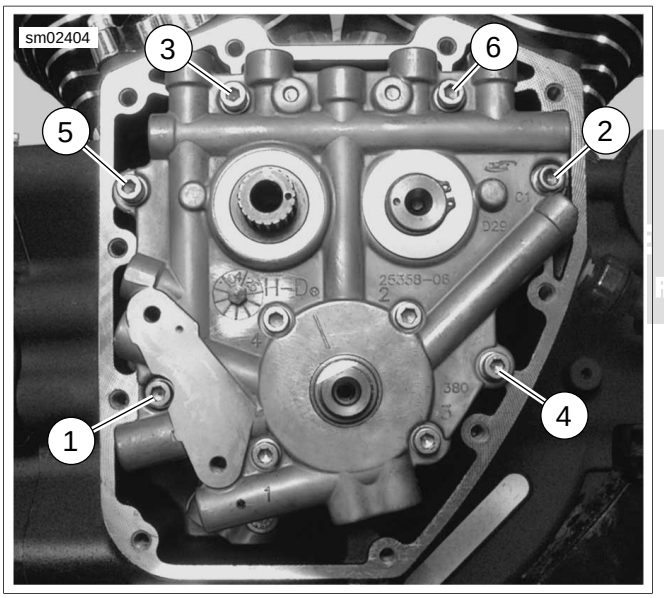
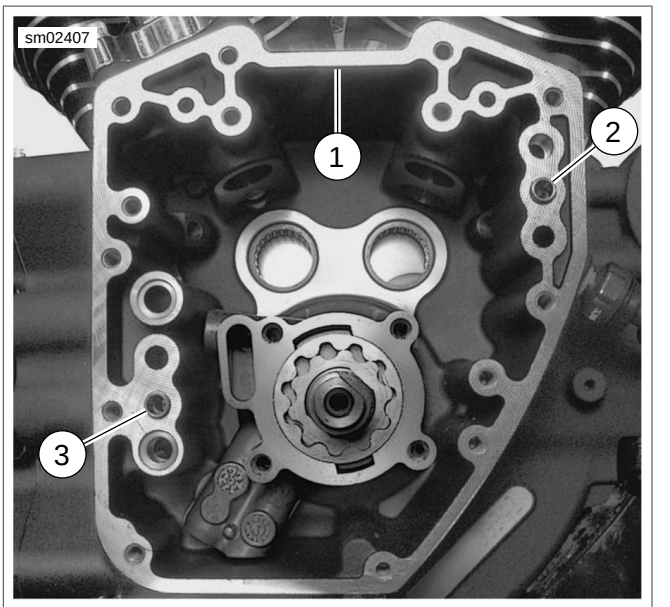


Figure 3-50. Cam Support Plate Torque Sequence

3. See Figure 3-51. Two ring dowels (2, 3) in crankcase flange locate cam support plate.
 a. Insert small pry bar (seal remover) between inboard side of cam support plate and crankcase flange in area adjacent to ring dowels.
 b. Alternately work each side free and then carefully ease cam support plate and camshafts from end of crankshaft.
4. See 3.26 CAM SUPPORT PLATE AND COVER for inspection and repair information.



1. **Right crankcase half**
2. **Forward ring dowel**
3. **Rear ring dowel**

Figure 3-51. Ring Dowels

CRANKCASE

1. Carefully pull oil pump from crankshaft.
2. See Figure 3-52. Remove o-rings (1, 2) from crankcase housing. Discard o-rings. See 3.27 OIL PUMP for inspection and repair information.

NOTE

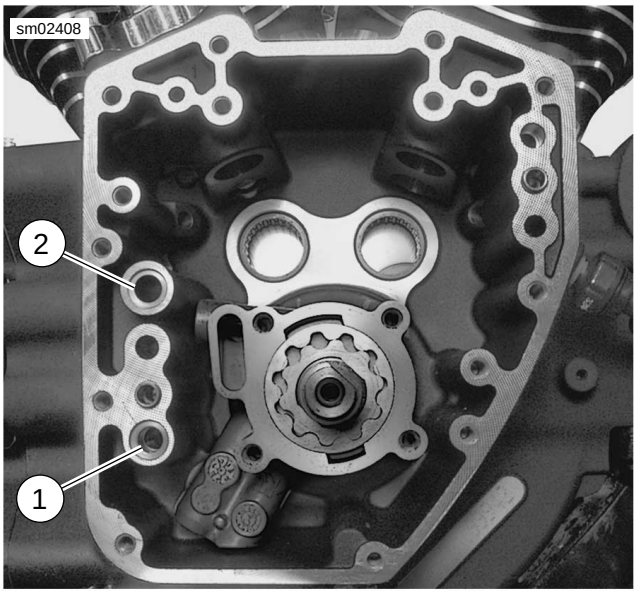
Do NOT rotate left crankcase half in the engine stand so the flywheel sprocket shaft is facing up. The flywheel assembly will fall out of the case.

3. Rotate crankcase in the engine stand so that the cam cover flange is facing straight upward.
4. See Figure 3-53. Remove the nine crankcase bolts in the sequence shown.

NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and may be dropped.

5. Separate case halves. Lift right crankcase half off end of crankshaft.
6. See Figure 3-54. Remove two dowel pins in split line face of right case half.
7. For inspection and repair information, see 3.28 CRANKCASE.



1. Oil feed hole O-ring
2. O-ring on crankcase post

Figure 3-52. Oil Pump O-rings

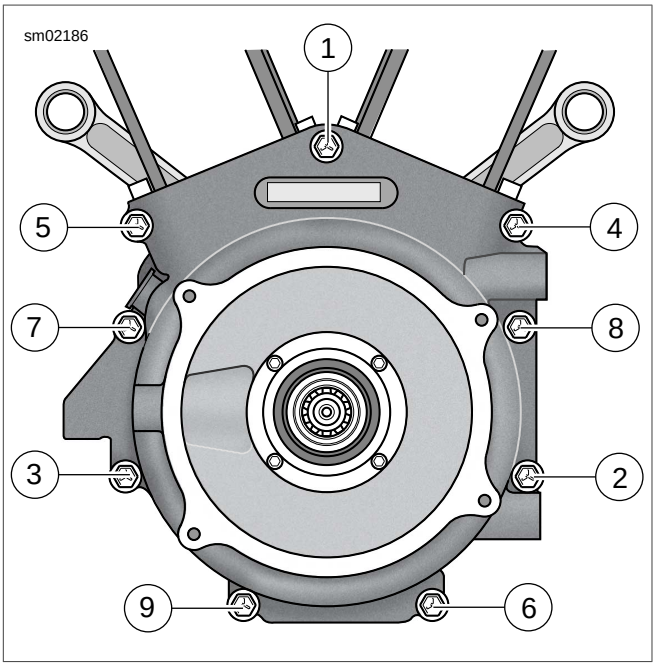


Figure 3-53. Crankcase Bolt Sequence

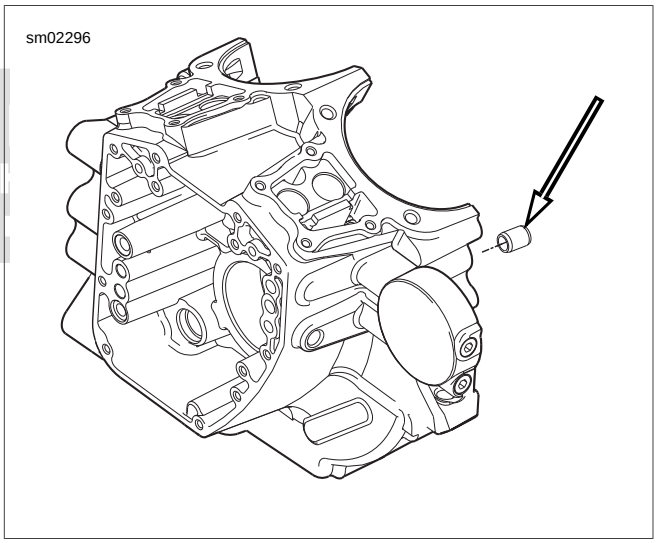


Figure 3-54. Right Crankcase Forward Dowel Pin (Rear Dowel Pin Not Shown)

BOTTOM END OVERHAUL: ASSEMBLY 3.19

GENERAL

This section lists a sequential process for engine reassembly after a complete bottom end disassembly and overhaul. If you reached this section after an inspection or repair procedure, start where necessary and continue to the end of the section.

- Crankcase installation: see 3.28 CRANKCASE.
- Cover and cam support plate installation: see 3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover.

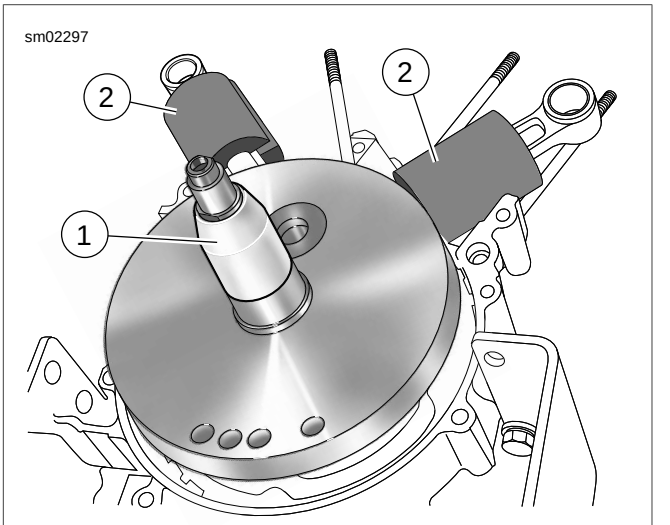
CRANKCASE

PART NUMBER	TOOL NAME
99650-02	HIGH-PERFORMANCE SEALANT, GRAY
HD-39361-B	SPROCKET SHAFT OIL SEAL INSTALLER
HD-42326-B	CRANKSHAFT GUIDE
HD-97225-55C	SPROCKET SHAFT BEARING INSTALLER

NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings keeping them packaged until use to avoid confusion.*

1. Bolt left crankcase half upright in engine stand.
2. To facilitate assembly and prevent damage to the crankshaft (roller) bearing in the left crankcase half, slide CRANKSHAFT GUIDE (Part No. HD-42326-B) onto flywheel sprocket shaft.
3. Slide flywheel assembly into left crankcase half. Remove CRANKSHAFT GUIDE tool.
4. Tip crankcase assembly in engine stand so that flywheel sprocket shaft is pointing straight up.
5. Verify that both dowel pins are installed in split line face of right case half.
6. With the right crankcase half resting on the cam cover flange, apply a bead of sealant approximately 0.056 in. (1.42 mm) wide to the split line face and around the two dowel pins. For best results, use HIGH-PERFORMANCE SEALANT, GRAY (Part No. 99650-02).
7. See Figure 3-55. To facilitate assembly and prevent damage to the crankshaft (roller) bearing in the right crankcase half, place CRANKSHAFT GUIDE (1) (Part No. HD-42326-B) over end of crankshaft until it contacts shoulder on shaft.
8. Mate case halves sliding bearing roller in right crankcase half over end of crankshaft. Remove CRANKSHAFT GUIDE.



1. **Crankshaft guide**
2. **Water pipe insulation**

Figure 3-55. Crankshaft Guide (Part No. HD-42326-A)

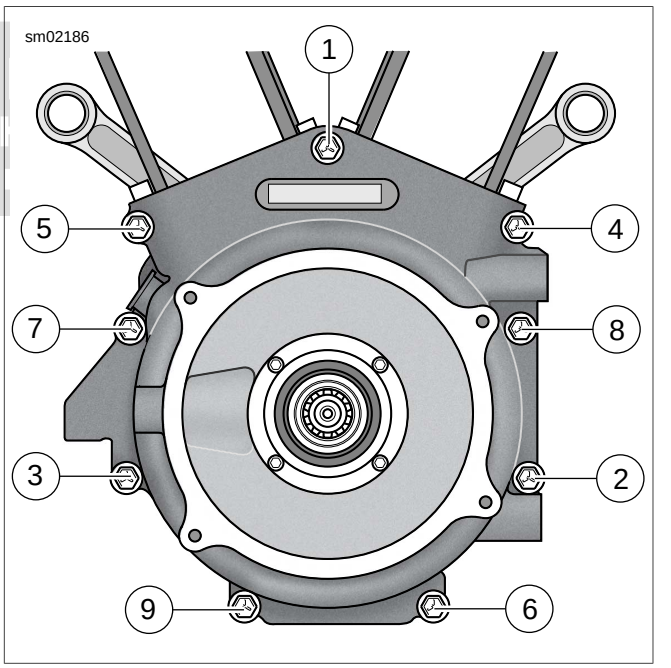
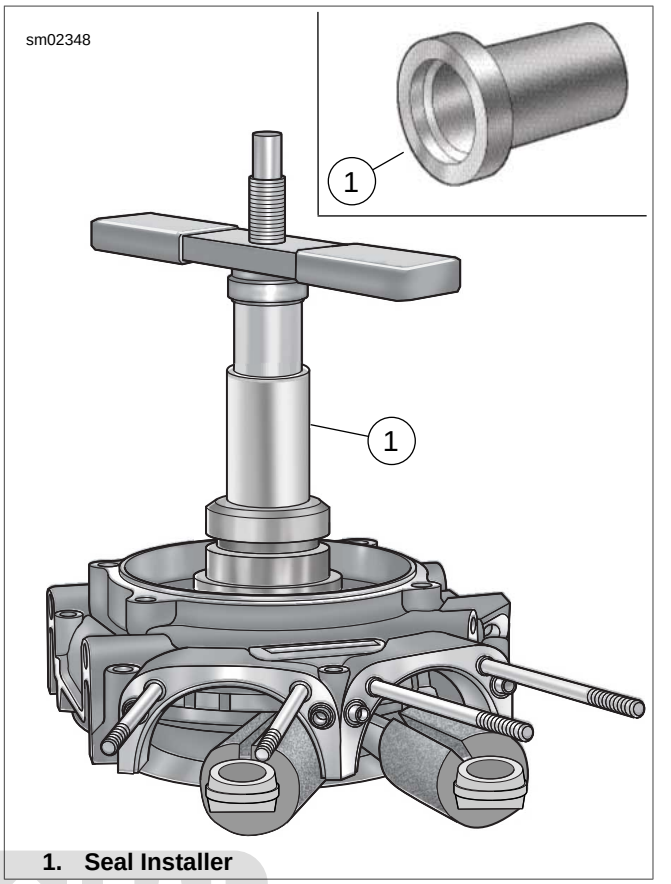


Figure 3-56. Tightening Crankcase Bolts

9. See Figure 3-56. Start the nine crankcase bolts and tighten in the following sequence.
 a. Alternately turn each crankcase bolt until finger tight.
 b. Tighten the crankcase bolts to 10 ft-lbs (13.6 Nm) in the order shown.
 c. Following the same sequence, tighten each bolt to 15-19 ft-lbs (20.3-25.8 Nm).

10. Tip crankcase assembly so that sprocket shaft is pointing straight up.
11. Install thrust washer on sprocket shaft with "THIS SIDE OUT" facing out (and the chamfer inboard). If using OE part without markings, orient as required to preserve existing wear pattern.
12. See Figure 3-57. Install **new** oil seal into bearing bore. Obtain pilot adapter, pilot shaft, short collar, Nice bearing, large flat washer and handle from SPROCKET SHAFT BEARING INSTALLER (Part No. HD-97225-55C).
 a. Thread pilot adapter into sprocket shaft.
 b. Thread pilot shaft onto pilot adapter.
 c. Verify that lip garter spring is in place on both sides of oil seal.
 d. Install sprocket shaft spacer in oil seal bore.
 e. With the lettering on the oil seal facing outside, slide sprocket shaft spacer and oil seal over pilot shaft until it contacts bearing bore.
 f. Slide SPROCKET SHAFT OIL SEAL INSTALLER (Part No. HD-39361-B) over pilot shaft until it contacts oil seal.
 g. Slide short collar over pilot shaft until it contacts seal installer.
 h. Slide Nice bearing and large flat washer over pilot shaft.
 i. Sparingly apply graphite lubricant to threads of pilot shaft to prolong service life and verify smooth operation.
 j. Thread handle onto pilot shaft to complete assembly of tool.
13. Rotate handle in a clockwise direction until oil seal installer makes firm contact with crankcase stator mount.
14. Remove handle, flat washer, Nice bearing, short collar, seal installer, pilot shaft and pilot adapter from sprocket shaft.
15. Rotate crankcase in engine stand so that cam cover flange is facing upward.



1. Seal Installer

Figure 3-57. Sprocket Shaft Oil Seal Installer

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTE

O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use new o-rings keeping them packaged until use to avoid confusion.

16. See Figure 3-58. Assemble and install oil pump. Lubricate parts with clean H-D 20W50 engine oil during assembly.
 a. Apply a very thin film of clean H-D 20W50 engine oil to **new** scavenge port stub o-ring (6). Install **new** o-ring on scavenge port stub of oil pump housing.
 b. Slide oil pump housing (5) onto crankshaft fitting o-ring on scavenge port stub into crankcase bore at back of cam compartment. Firmly push on scavenge port stub with thumb to be sure that it is snug in bore. Inspect o-ring on stub to verify that it is not pinched or distorted.
 c. Separate the gerotor gears into two sets, one wide (4) (scavenge) and the other narrow (1) (feed).

NOTE

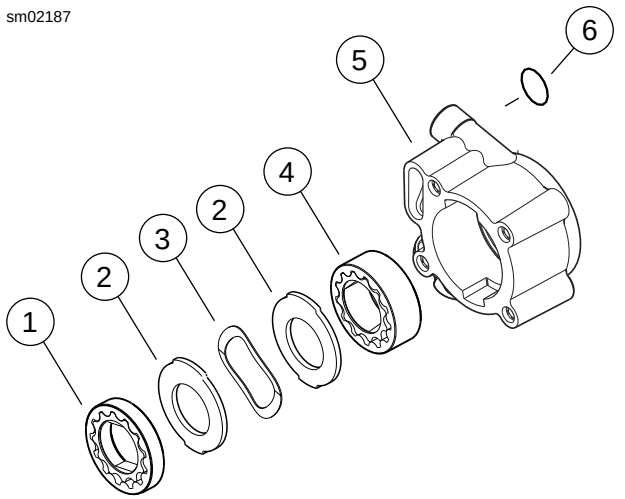
Lubricate oil pump parts with clean H-D 20W50 motor oil during assembly.

d. Fit the smaller of the wide gerotor gears into the larger. Slide the wide gerotor set (4) down the crankshaft until it bottoms in the oil pump housing.

e. Slide inside separator plate (2) down the crankshaft until it contacts the wide gerotor set (4). Install wave washer (3) and outside separator plate (2).

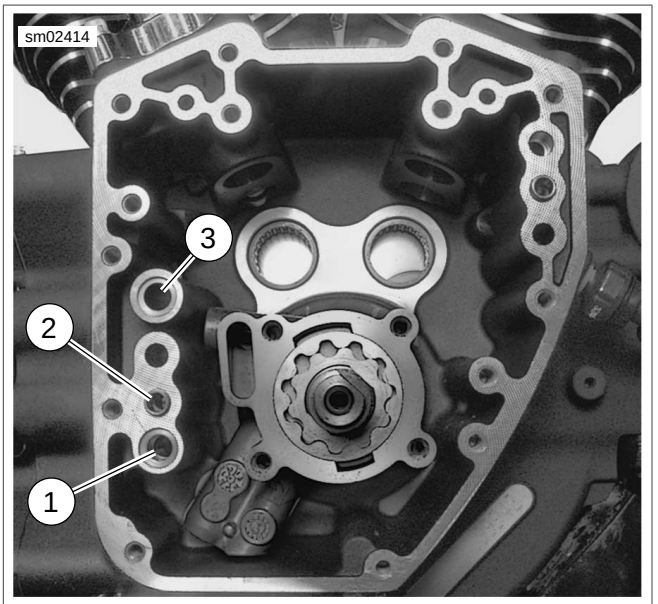
f. Fit the smaller of the narrow gerotor gears into the larger. Slide the narrow gerotor set (1) down the crankshaft until it contacts the outside separator plate (2).

g. See Figure 3-59. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring (3) for crankcase post. Install **new** o-ring in groove on crankcase post.



1. **Narrow gerotor set (feed)**
2. **Separator plate**
3. **Wave washer**
4. **Wide gerotor set (scavenge)**
5. **Oil pump housing**
6. **Scavenge port O-ring**

Figure 3-58. Assembling Oil Pump



1. **Oil feed hole O-ring**
2. **Rear ring dowel**
3. **O-ring on crankcase post**

Figure 3-59. Oil Feed Hole

CAM SUPPORT PLATE AND COVER

PART NUMBER	TOOL NAME
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL

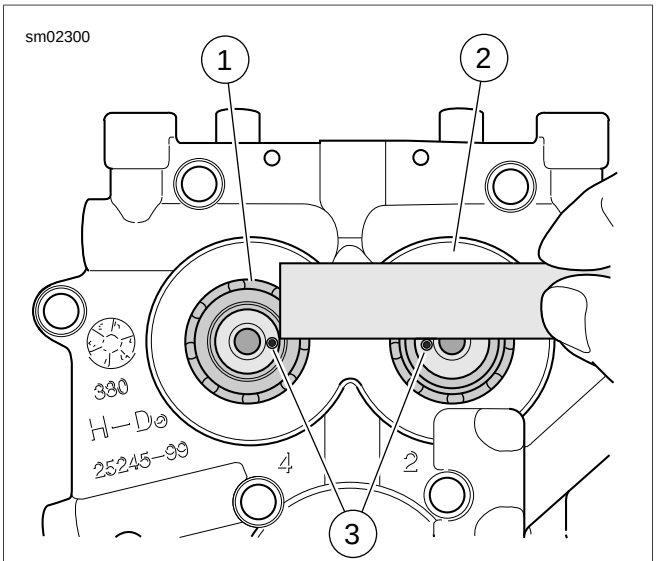
NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings keeping them packaged until use to avoid confusion.*

1. See Figure 3-59. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring (1) for crankcase flange. Install **new** o-ring in groove around oil feed hole directly below rear ring dowel (2).

2. Lubricate cam needle bearings with clean H-D 20W50 engine oil.

3. See Figure 3-60. Using a straightedge, verify that the timing marks on the ends of the front and rear camshafts are in alignment. If necessary, rotate camshafts in order to make this observation.



1. **Rear camshaft**
2. **Front camshaft**
3. **Timing marks**

Figure 3-60. Verify Alignment of Timing Marks

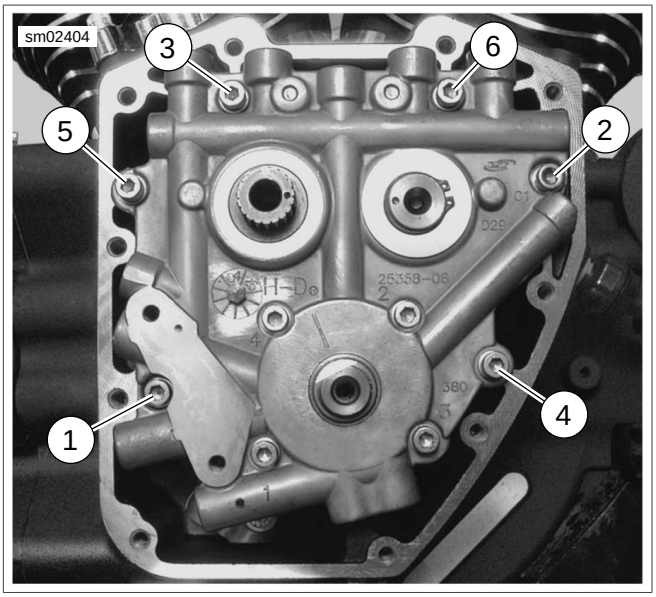


Figure 3-61. Cam Support Plate Torque Sequence

4. Aligning bushing in cam support plate with end of crankshaft, slide cam support plate over crankshaft onto two ring dowels in crankcase flange. Use a rubber mallet to fully seat cam support plate on ring dowels.
5. See Figure 3-61. Install cam support plate screws.
 a. Loosely install the six screws (1/4 x 1.0 in.) to secure the cam support plate to the crankcase flange.
 b. Tighten screws to 90-120 **in-lbs** (10.2-13.6 Nm) in the sequence shown.
6. See Figure 3-62. Install oil pump.
 a. Start four screws (1/4 x 1.0 in.) to secure oil pump.

 NOTE

 For methods of engine rotation, see 3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate.

 b. While rotating the engine, enabling the pump to find its natural center, alternately tighten screws (1 and 2) until snug.
 c. Tighten the screws (3 and 4) until snug.
 d. Tighten all four screws to 40-45 **in-lbs** (4.5-5.1 Nm) in sequence shown.
 e. Final tighten all four screws to 90-120 **in-lbs** (10.2-13.6 Nm) in the sequence shown. Numbers cast adjacent to the bolt holes also indicate the oil pump torque sequence.
7. With the lettering facing inboard, install rear cam sprocket spacer onto the rear camshaft.

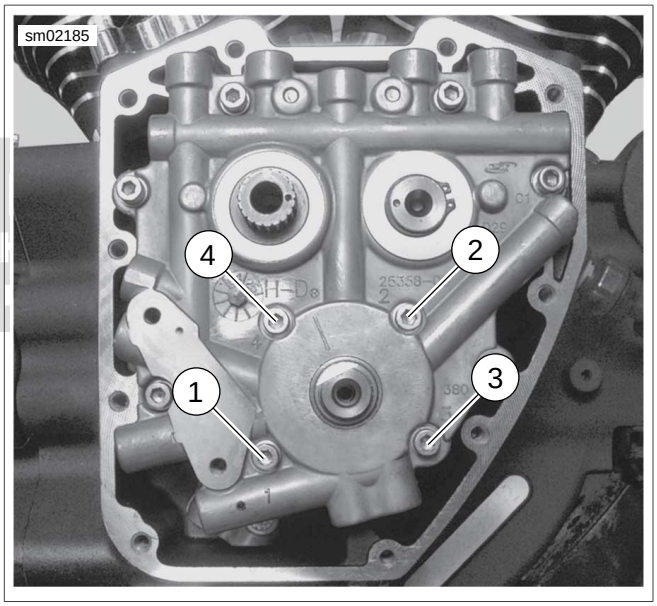


Figure 3-62. Oil Pump Torque Sequence

8. If using the original cam support plate, camshafts, primary cam sprocket, crank sprocket and flywheel assembly, then move to next step. However, if any of these parts have been replaced, then proceed as follows:
 a. Install primary cam sprocket onto splines of rear camshaft. Install long flange bolt with thicker flat washer to secure sprocket to end of camshaft.
 b. Install crank sprocket onto crankshaft. Install short flange bolt with a temporary smaller diameter flat washer from bulk inventory.

NOTE

Use of smaller diameter flat washer with crank sprocket flange bolt allows room on sprocket face for placement of straightedge.

c. See Figure 3-63. To prevent rotation, position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between the crank and primary cam sprockets. The handle of the tool is stamped "Crank" and "Cam" to verify proper orientation. Tighten the crank and primary cam sprocket flange bolts to 15 ft-lbs (20.3 Nm). Remove the sprocket locking tool.

d. Rotate engine stand so cam compartment is pointing upward. Push on crankshaft and rear camshaft to eliminate endplay.

 If engine was not removed from motorcycle, install compensating sprocket assembly to pull the crankshaft to the left side of the engine. Push on crankshaft and rear camshaft to eliminate endplay.

e. See Figure 3-64. Place a straightedge across the crank and primary sprocket faces. Attempt to insert a 0.010 in. (0.254 mm) feeler gauge between the straightedge and the each sprocket face. If the feeler gauge will not fit at either location, sprocket offset is within specification. Remove both sprockets and discard temporary small washer.

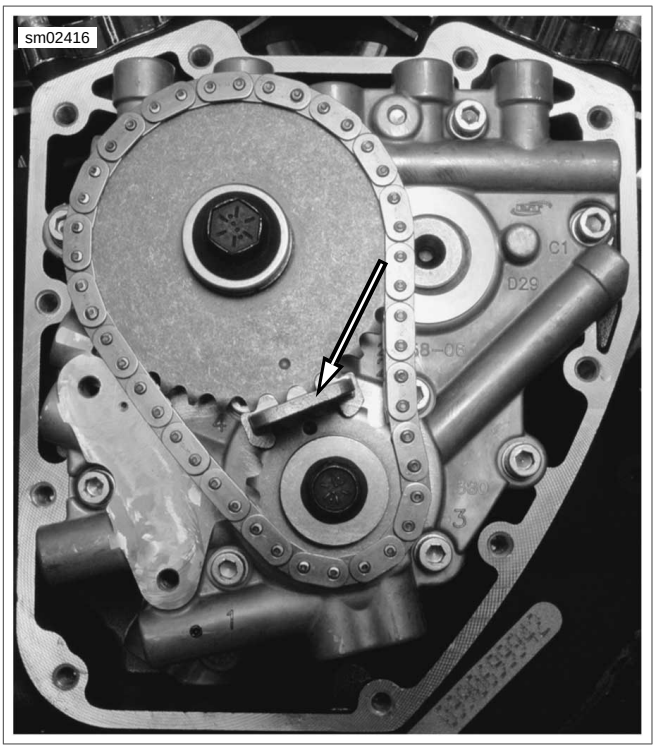


Figure 3-63. Camshaft Locking Tool

NOTE

Height differences between rear cam sprocket and crank sprocket can be addressed by changing the spacer behind the rear cam sprocket. See spacer sizes in Table 3-33.

f. If the crank sprocket rises above the face of the rear cam sprocket more than 0.010 in. (0.254 mm), remove the flange bolt and rear cam sprocket. Note the part number stamped on the existing spacer behind rear cam sprocket. Replace spacer with the next larger size.

 If the rear cam sprocket rises above the face of the crank sprocket more than 0.010 in. (0.254 mm), replace the spacer with the next smaller size only.

g. Repeat height inspection with the **new** spacer installed. Remove both sprockets when measurement is within specification and discard temporary small washer.

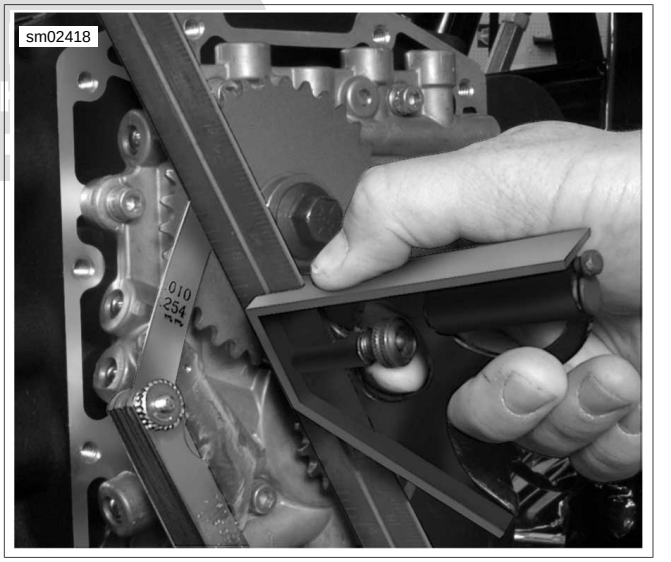


Figure 3-64. Check Alignment of Crank and Rear Cam Sprocket Faces

Table 3-33. Rear Cam Sprocket Spacers

PART NO.	IN.	MM.
25729-06	0.100	2.54
25731-06	0.110	2.79
25734-06	0.120	3.05
25736-06	0.130	3.30
25737-06	0.140	3.56
25738-06	0.150	3.81

9. See Figure 3-65. Apply a light amount of clean H-D 20W50 oil to splines on rear cam. Install the primary cam chain and sprocket assembly.
 a. Place the rear cam sprocket (2) in the primary chain. Hold the sprocket allowing the chain to hang loose. Rotate the sprocket so that the timing mark on the sprocket root faces straight downward.

 NOTE

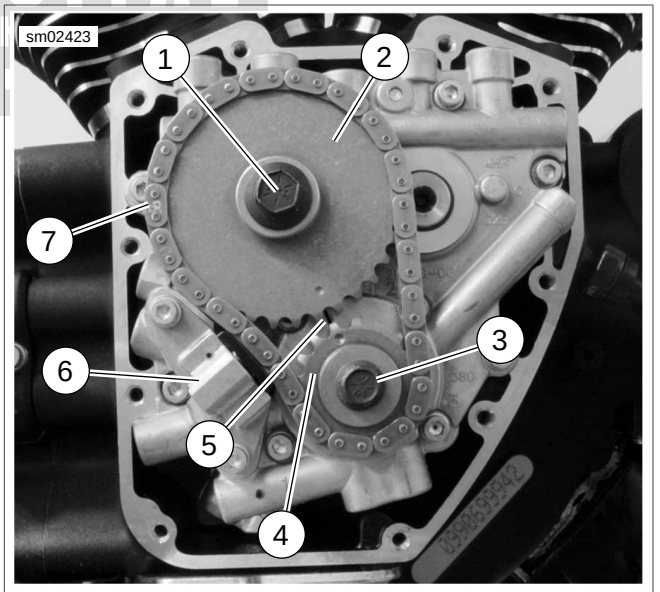
 To maintain the original direction of rotation, verify that the colored mark placed on the chain link (7) and crank sprocket (4) is visible during installation.

 b. Place the crank sprocket (4) in the opposite end of the chain with the timing mark on the sprocket tooth facing straight upward (directly toward the cam sprocket timing mark).
 c. Maintaining the position of the sprockets on the chain with the timing marks in alignment, start the rear cam sprocket onto the end of the rear camshaft. Note that the sprocket has an integral key that must be aligned with the keyway in the camshaft.
 d. Maintaining the position of the crank sprocket on the chain, rotate the rear cam sprocket in a clockwise direction until the flat on the crank sprocket is aligned with the flat on the crankshaft. Install the crank sprocket.
10. Rotate the rear cam sprocket in a clockwise direction until the timing mark on the root is aligned with the timing mark on the crank sprocket tooth. Locate alignment mark (5) on cam support plate to verify that the timing marks are in alignment.

NOTES

- *If the timing marks are not in alignment, then the sprockets must be removed and reinstalled. Misaligned sprockets will make the engine run erratically.*
- *Rear sprocket bolt and crank sprocket bolt must install freely by hand. Before installing bolts, remove any build-up of LOCTITE THREADLOCKER from the bolt holes with the proper sized thread chaser.*
- *Both crank and rear cam sprocket flange bolts are specially hardened while the flat washers are of a special diameter. Use only genuine Harley-Davidson parts when replacement is necessary. If **new** flange bolts are not available, thoroughly clean both internal and external threads and apply a **small** amount LOCTITE THREADLOCKER 262 (red) before installation. The crank and rear cam sprocket flange bolts and flat washers are **not** interchangeable.*

11. Apply oil to bottom of **new** crank flange bolt head and washer (3). Loosely install to secure crank sprocket (4) to end of crankshaft.
12. Apply oil to bottom of **new** rear cam sprocket bolt head and washer (1). Loosely install to secure rear cam sprocket (2) to end of camshaft.
13. Position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between the crank and rear cam sprockets to prevent rotation. The handle of the tool is stamped "Crank" and "Cam" to verify proper orientation.
 a. Tighten both sprocket bolts (1, 3) to 15 ft-lbs (20.3 Nm).
 b. Loosen both bolts one revolution (360 degrees).
 c. Final tighten the rear cam sprocket bolt (1) to 34 ft-lbs (46.1 Nm).
 d. Final tighten the crank sprocket bolt (3) to 24 ft-lbs (32.5 Nm).
 e. Remove the sprocket locking tool.
14. Install primary cam chain tensioner. Tighten fasteners to 100-120 **in-lbs** (11.3-13.6 Nm).
15. Apply clean H-D 20W50 engine oil to crank and rear cam sprockets.
16. See Figure 3-66. Align holes in **new** cam cover gasket with those in the crankcase flange.



1. **Rear cam sprocket bolt (large) and flat washer**
2. **Rear cam sprocket**
3. **Crank sprocket bolt (small) and flat washer**
4. **Crank sprocket**
5. **Alignment mark on support plate**
6. **Primary chain tensioner**
7. **Marked link**

Figure 3-65. Primary Chain and Sprockets

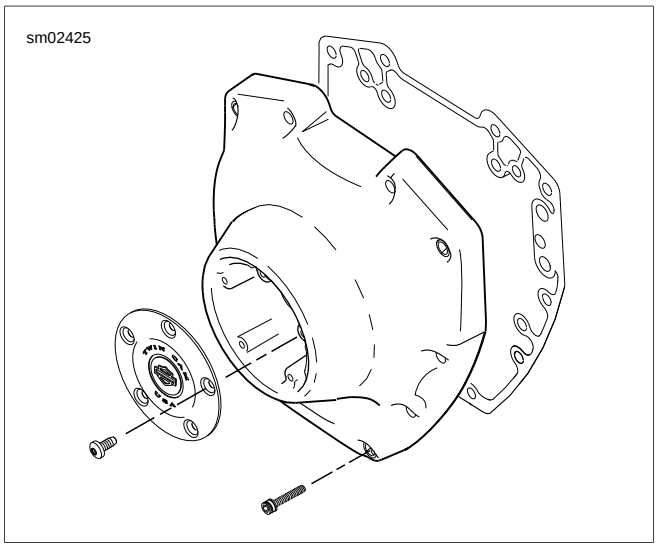


Figure 3-66. Cam Cover Gasket

NOTE

Before installing cam cover, verify cleanliness of blind holes in the crankcase flange. Tightening a screw with dirt, water or oil in the hole can cause the casting to crack or break. Damage to the casting requires replacement of the right crankcase half.

17. See Figure 3-65. Install the cam cover using ten allen head socket screws (1/4 x 1-1/4 in.). Following the sequence shown, alternately tighten the screws to 125-155 **in-lbs** (14.1-17.5 Nm). If cam cover assembly was completely removed continue as follows.

18. Complete motorcycle assembly.
 a. If engine was completely overhauled, see 3.17 TOP END OVERHAUL: ASSEMBLY. Perform all steps.
 b. If only cam compartment components were serviced, install push rod covers, push rods, rocker arm support plate and breather assembly. See appropriate topics under 3.17 TOP END OVERHAUL: ASSEMBLY.

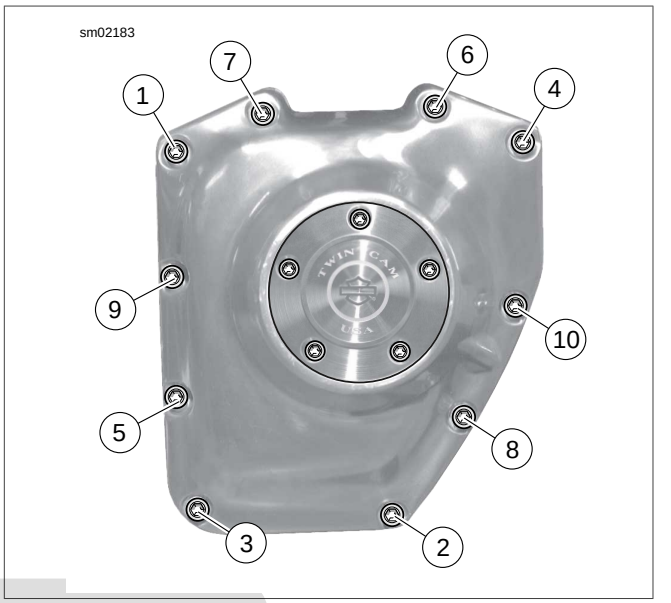


Figure 3-67. Cam Cover Screws

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

BREATHER ASSEMBLY 3.20

REMOVAL OVERVIEW

To remove breather assembly, see 3.16 TOP END OVERHAUL: DISASSEMBLY.

DISASSEMBLY

1. See Figure 3-68. Remove two fasteners (1) from the breather assembly cover (2) and remove breather assembly from rocker arm support plate (8).
2. Remove the breather cover and cover gasket (3). Discard gasket. Remove breather baffle (5) and breather baffle gasket (7). Discard gasket. Pull filter element (6) from bore on underside of breather baffle. Pull umbrella valve (4) from hole at top of breather baffle. Discard both filter element and umbrella valve.

CLEANING AND INSPECTION

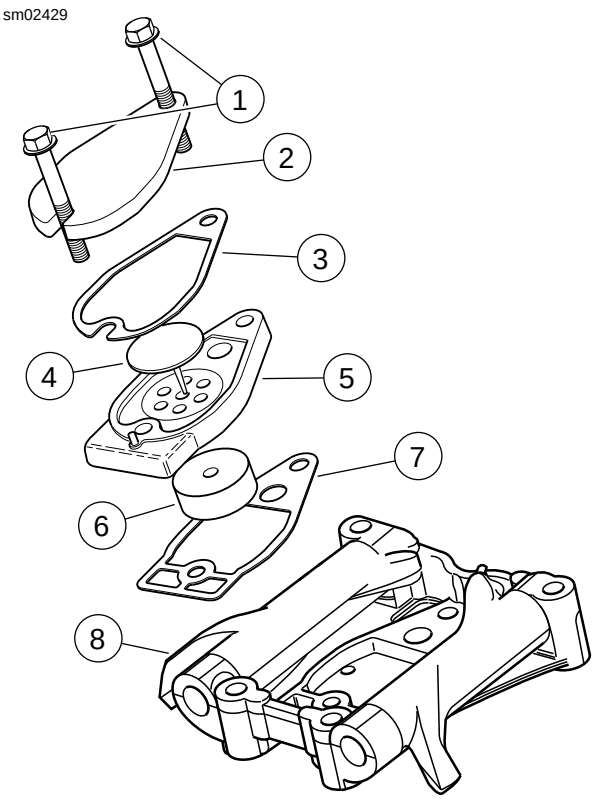
⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

1. Clean all parts in a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air.
2. See Figure 3-68. Set a straightedge diagonally across the length of the breather cover (2) intersecting the opposite corners of the gasket surface. Slide a feeler gauge beneath the straightedge to check the breather cover for warpage. Repeat the step checking the opposite diagonal. Discard the breather cover if any low spot exceeds 0.005 in. (0.13 mm).
3. Using method outlined in previous step, inspect the breather baffle (5) gasket surface for flatness. Discard the breather baffle if any low spot exceeds 0.005 in. (0.13 mm).

ASSEMBLY

1. See Figure 3-68. Insert stem of **new** umbrella valve (4) through center hole at top of breather baffle (5). Carefully pull rubber bead on stem through hole in baffle. Use denatured alcohol or glass cleaner to lubricate stem, if necessary. Verify that rubber bead is pulled completely through hole and resides on bottom side of baffle.
2. Press **new** filter element (6) into bore at bottom of baffle. Hole in filter element accommodates umbrella valve stem.
3. Place breather baffle gasket (7) on a clean flat surface.
 a. Aligning holes, place breather baffle (5), cover gasket (3) and breather cover (2) on top of breather baffle gasket.
 b. Slide two fasteners (1) through stackup to keep assembly together until time of installation.



1. **Fasteners (2)**
2. **Breather cover**
3. **Cover gasket**
4. **Umbrella valve**
5. **Breather baffle**
6. **Filter element**
7. **Breather baffle gasket**
8. **Rocker arm support plate**

Figure 3-68. Breather Assembly

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly.

1. Install breather assembly.
2. Continue with vehicle assembly as directed.

ROCKER ARM SUPPORT PLATE 3.21

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.

DISASSEMBLY

1. See Figure 3-69. Remove four bolts with flat washers (1) from the rocker arm support plate (5). The rocker arm shafts (4) on the push rod side (right) are notched to lock them in position.
2. Using a hammer and brass drift, tap left side of rocker arm shafts (4) so that the notched ends exit the rocker arm support plate (5) first. Mark the shafts so that they are installed in their original locations at time of assembly.
3. Remove the rocker arms from the rocker arm support plate. Mark the rocker arms to indicate location.

CLEANING AND INSPECTION

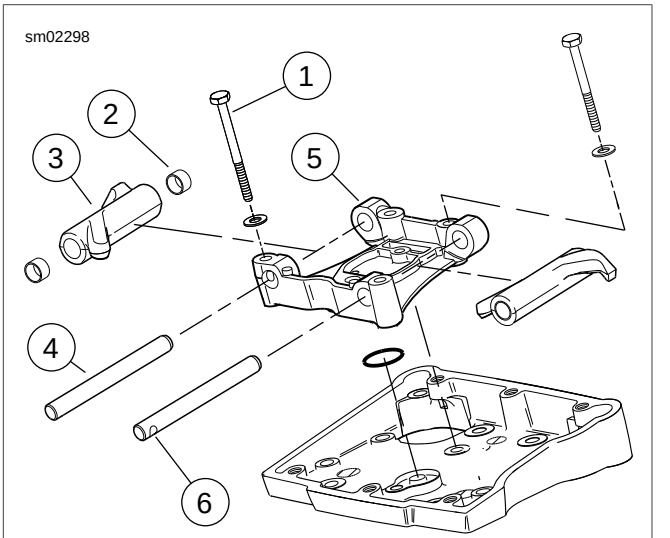
PART NUMBER	TOOL NAME
HD-94804-57	ROCKER ARM BUSHING REAMER

Inspection

WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

1. Clean all parts in a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air.
2. See Figure 3-69. Check rocker arms (3) for uneven wear or pitting where contact is made with the valve stem tips. Check for concave wear where rocker arms contact the push rod ends. Replace rocker arm if excessive wear is found at either location.
3. Verify that oil holes in rocker arms and rocker arm support plate (5) are clean and open.
4. Inspect rocker arm shafts (4) for scratches, burrs, scoring or excessive wear. Replace as necessary.



1. **Bolt with flat washer**
2. **Rocker arm bushings**
3. **Rocker arm**
4. **Rocker arm shaft**
5. **Rocker arm support plate**
6. **Notch**

Figure 3-69. Rocker Arm Assembly

Rocker Shaft Fit

1. See Figure 3-70. Measure the inside diameter of the rocker arm support plate bore.
2. See Figure 3-71. Measure the outside diameter of the rocker arm shaft where it fits in the bore.
3. Repeat the measurement on opposite side of support plate and shaft. Replace shaft or support plate if clearance equals or exceeds 0.0035 in. (0.089 mm).

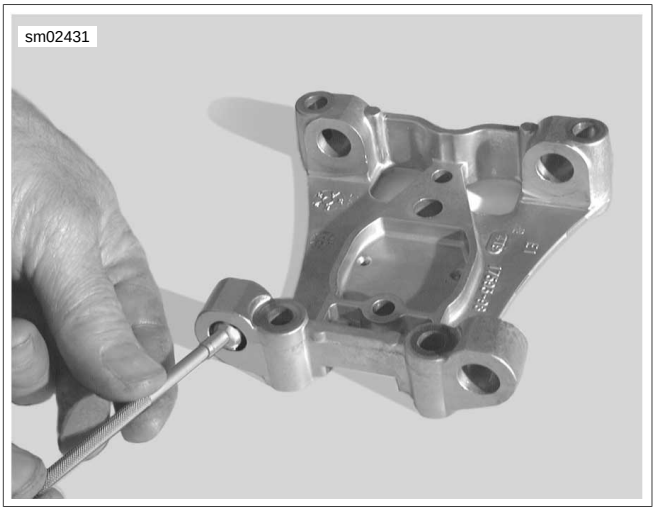


Figure 3-70. Checking Support Plate Bore



Figure 3-71. Checking Shaft to Support Plate Fit



Figure 3-73. Checking Shaft to Bushing Fit

Rocker Arm Shaft to Bushing

1. Check rocker arm shaft to bushing fit.
 a. See Figure 3-72. Measure the inside diameter of the rocker arm bushing.
 b. See Figure 3-73. Measure the outside diameter of the rocker arm shaft where it rides in the bushing.
2. Repeat measurement on opposite side of rocker arm and shaft. Replace shaft or bushings if clearance equals or exceeds service wear limit of 0.0035 in. (0.089 mm).

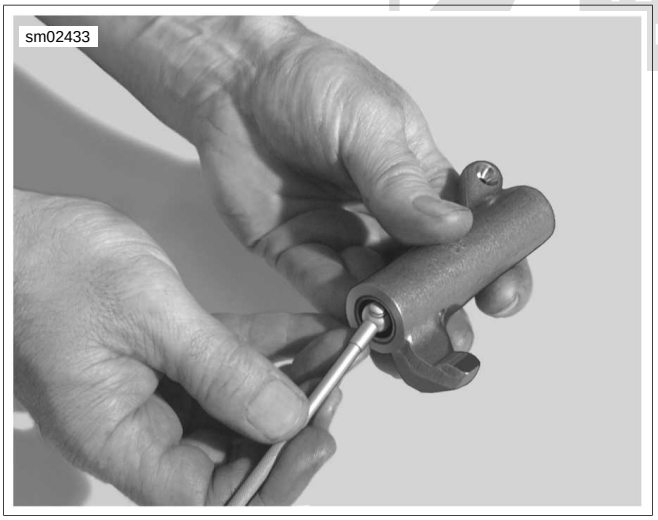


Figure 3-72. Checking Bushings

Replace Rocker Arm Bushings

NOTE

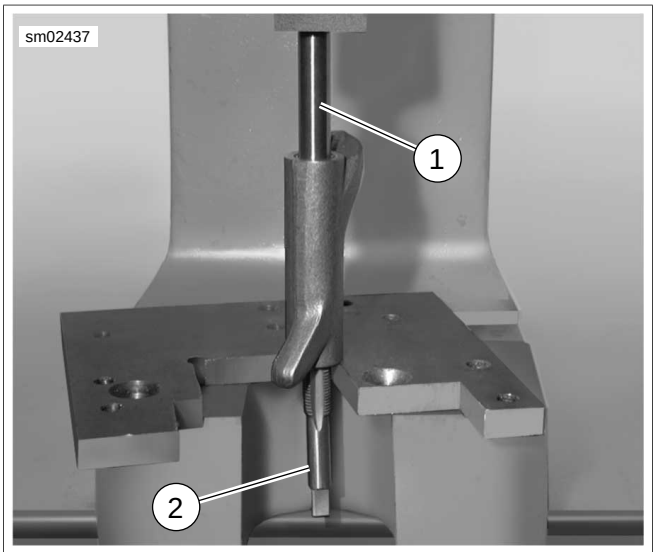
Bushing replacement and reaming must be done one at a time to ensure proper alignment. Follow all steps for one bushing and then repeat for the other bushing.

1. See Figure 3-74. Turn a 9/16"-18 tap (2) into bushing until tight. Place rocker arm under ram of arbor press with tap at bottom. Slide a discarded rocker arm shaft (1) through open end of rocker arm until contact is made with tap. Using shaft as driver (and untapped bushing as pilot), press against shaft until both tap and bushing are free.
2. See Figure 3-75. Using a suitable driver, press **new** bushing into side of rocker arm until flush with casting. Be sure to orient bushing so that split line faces top of rocker arm.

NOTE

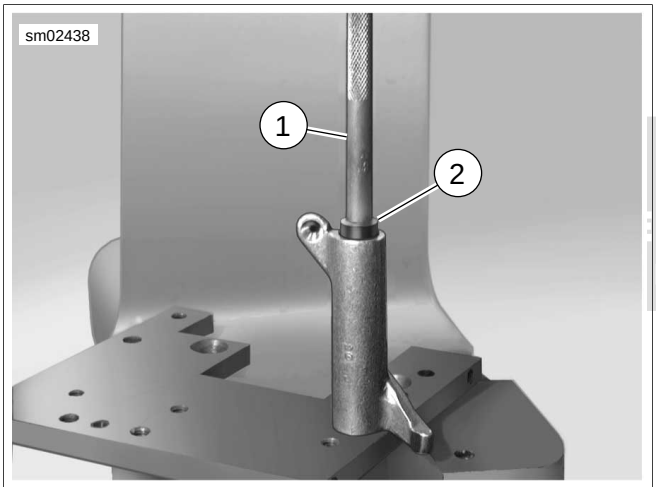
Never back reamer out of rocker arm or new bushing will be damaged.

3. See Figure 3-76. Lock rocker arm in a vise using brass jaw inserts or shop towels to prevent casting damage. Insert tapered end of ROCKER ARM BUSHING REAMER (Part No. HD-94804-57) into old bushing in rocker arm. Note that old bushing on drive side of reamer as pilot. Rotate reamer until the **new** bushing on the far side is reamed, and then continuing in the same direction, draw drive side of reamer from **new** bushing.
4. Repeat steps to remove, install and ream second bushing.



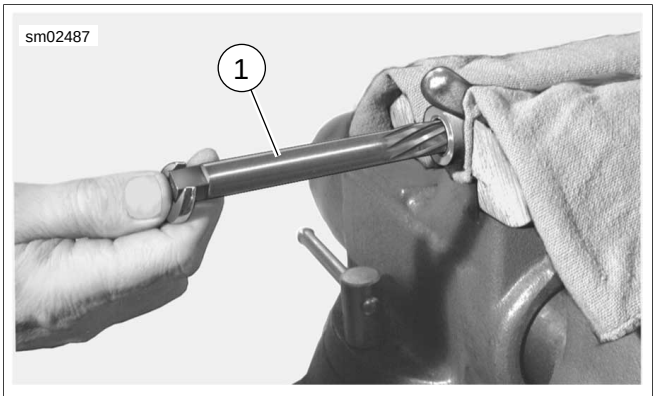
1. **Discarded shaft used as driver**
2. **Tap**

Figure 3-74. Removing Bushing



1. **Driver**
2. **Bushing**

Figure 3-75. Installing Bushing



1. **Reamer**

Figure 3-76. Ream Bushing

ASSEMBLY

1. Place the rocker arms into position on the rocker arm support plate.
2. Push the un-notched ends of the rocker arm shafts into the right side of the support plate and then into the rocker arms. As they approach their fully installed positions, rotate the shafts so that the notches are aligned with the bolt holes in the support plate.
3. See Figure 3-77. Check for proper end play.
 a. Insert a feeler gauge between the rocker arm and support plate.
 b. Repeat measurement on other rocker arm.
 c. Replace the rocker arm, rocker arm support plate or both if end play exceeds 0.025 in. (0.635 mm).
4. Install the four bolts with flat washers in the rocker arm support plate. Remember that the two bolts on the push rod side (right) must engage the notches in the rocker arm shafts for proper assembly.



Figure 3-77. Check End Play

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install rocker arm support plate.
2. Install breather assembly.
3. Continue with vehicle assembly as directed.

PUSH RODS, LIFTERS AND COVERS 3.22

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods, lifters and covers.

DISASSEMBLY

See Figure 3-78. With the exception of the lifter covers, all parts should have been disassembled and marked during the removal procedure. Disassemble the lifter covers as follows:

1. Separate upper (2) and lower push rod covers (8).
2. Remove o-ring (9) from seat at bottom of lower push rod cover. Discard o-ring.
3. Remove o-ring (1) from seat at top of upper push rod cover. Slide o-ring (7), flat washer (6), spring (5) and spring cap (4) from body of upper push rod cover (2). Discard o-rings.

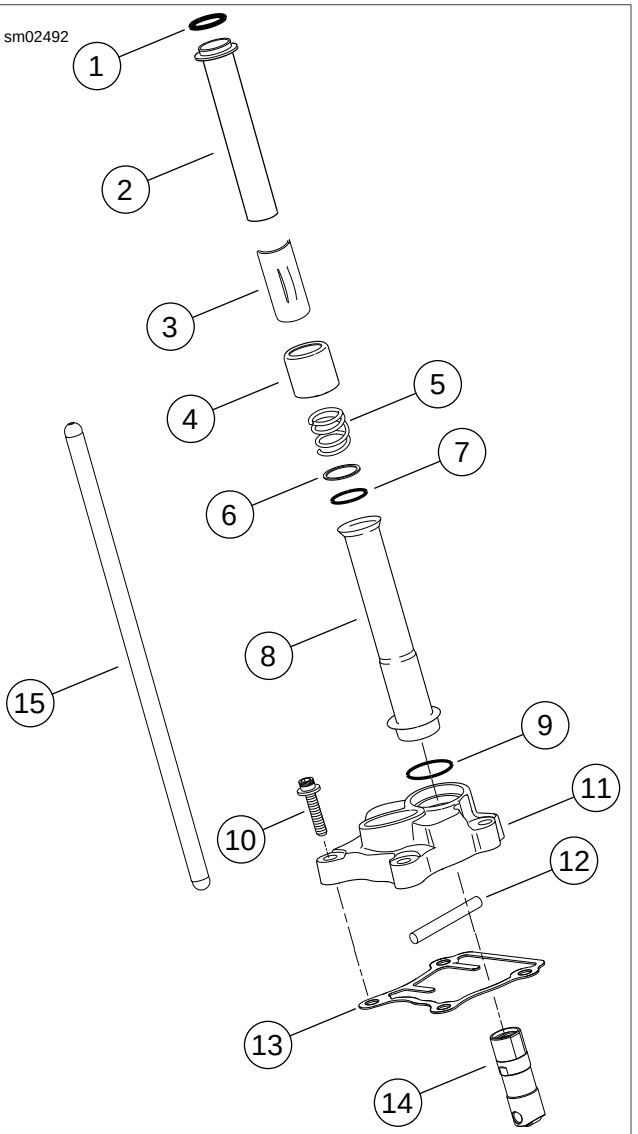
CLEANING AND INSPECTION

1. See Figure 3-78. Scrape old gasket material from the lifter cover (11) flange. Old gasket material left on mating surfaces will cause leaks.
2. With the exception of the hydraulic lifters (14), clean all parts in a non-volatile cleaning solution or solvent. Verify that the o-ring seats and contact surfaces of the push rod covers (2, 8) are completely clean.

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

3. Blow parts dry with low pressure compressed air. Verify that all oil holes are clean and open.
4. Verify that the hydraulic lifter rollers turn freely and are free of flat spots, scuff marks and pitting. If flat spots exist, examine the cam lobe on which the lifter operates.
5. Inspect the lifter socket for signs of wear. Verify that the plunger of the hydraulic lifter is fully extended up against the C-clip. Use index finger to pump plunger to verify lifter operation.
6. Examine the push rods (15). Replace any push rods that are bent, dented, broken or discolored. Replace the rod if the ball ends show signs of excessive wear or damage.
7. Cover all parts with a clean plastic sheet to protect them from dust and dirt.



1. **Upper O-ring (small)**
2. **Upper push rod cover**
3. **Spring cap retainer**
4. **Spring cap**
5. **Spring**
6. **Flat washer**
7. **Middle O-ring (intermediate)**
8. **Lower push rod cover**
9. **Lower O-ring (large)**
10. **Lifter cover screw**
11. **Lifter cover**
12. **Anti-rotational pin**
13. **Lifter cover gasket**
14. **Hydraulic lifter**
15. **Push rod**

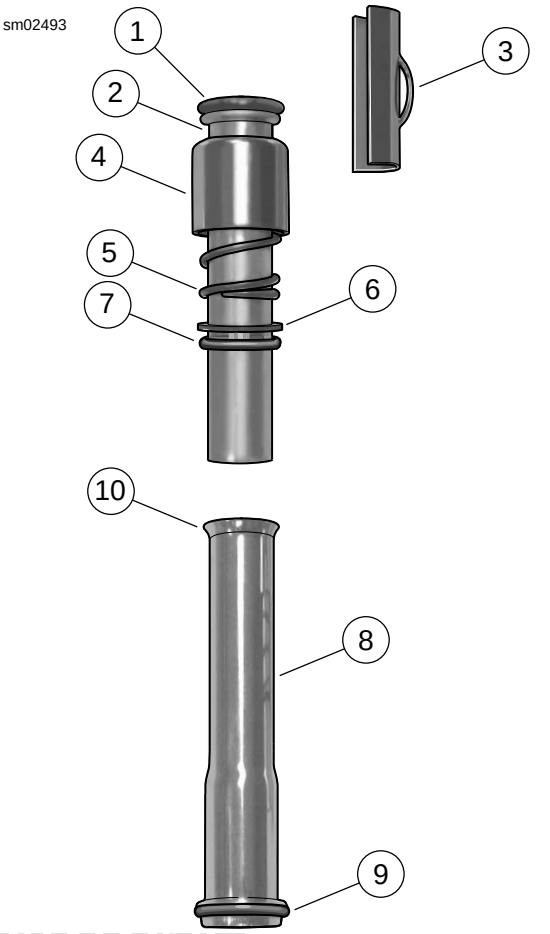
Figure 3-78. Push Rods, Lifters and Covers

LIFTER INSPECTION

NOTE

Inside and outside micrometers used for measuring lifters and lifter bores must be calibrated to ensure accurate readings.

1. Inspect lifters for excessive clearance in bores. Accurately measure the lifter outer diameter and record the measurement.
2. Accurately measure lifter bore inner diameter with a snap gauge. Subtract this measurement from the lifter measurement to determine clearance.
 a. Clearance should be within 0.0008-0.0020 in. (0.0203-0.0508 mm).
 b. Install new lifters and/or replace crankcases if clearance exceeds SERVICE WEAR LIMIT of 0.0030 in (0.076 mm).
3. Check lifter roller radial play.
 a. Roller radial movement should be within 0.0006-0.0010 in (0.0152-0.0254 mm).
 b. Replace lifters if radial movement exceeds SERVICE WEAR LIMIT of 0.0015 in. (0.0381 mm).
4. Check lifter roller end clearance.
 a. End clearance should be within 0.008-0.022 in. (0.203-0.559 mm).
 b. Replace lifters if end clearance exceeds SERVICE WEAR LIMIT of 0.022 in. (0.559 mm).
5. Soak lifters in clean engine oil. Keep covered until assembly.



1. **Upper O-ring (small)**
2. **Upper push rod cover**
3. **Spring cap retainer**
4. **Spring cap**
5. **Spring**
6. **Flat washer**
7. **Middle O-ring (intermediate)**
8. **Lower push rod cover**
9. **Lower O-ring (large)**
10. **Flared end of lower push rod cover**

Figure 3-79. Assembled Push Rod Cover

ASSEMBLY

With the exception of the push rod covers, all parts will be assembled during the installation procedure. Assemble the push rod covers as follows:

NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings keeping them packaged until use to avoid confusion.*

1. See Figure 3-79. Obtain three **new** o-rings (1, 7 and 9). Apply a very thin film of clean H-D 20W50 engine oil to o-rings before installation.
2. Install **new** small o-ring (1) on seat at the top of the upper push rod cover (2).

3. Slide the spring cap (4), spring (5), flat washer (6) and **new** intermediate size o-ring (7) onto the body of the upper push rod cover. Move parts up body until spring cap (4) contacts upper o-ring seat.
4. Fit the straight end of the upper push rod cover into the flared end of the lower push rod cover (8).
5. Install **new** large o-ring (9) on seat at bottom of lower push rod cover.

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install push rods, lifters and lifter covers.
2. Install rocker arm support plate.
3. Install breather assembly.
4. Continue with vehicle assembly as directed.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

CYLINDER HEAD 3.23

REMOVAL OVERVIEW

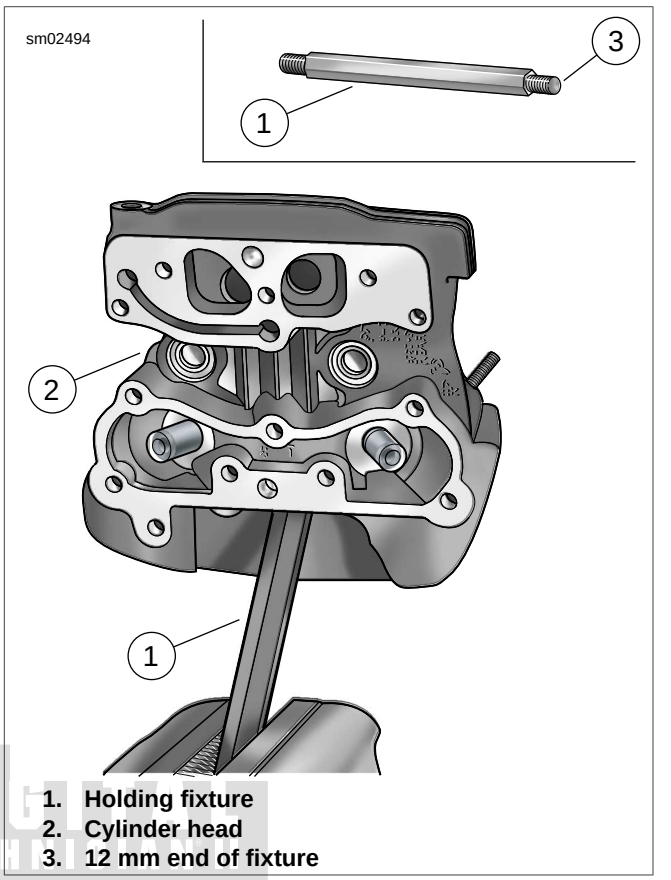
See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-34736-B	VALVE SPRING COMPRESSOR
HD-39786	CYLINDER HEAD HOLDING FIXTURE

1. Before proceeding with the disassembly procedure, determine if cylinder head reconditioning is necessary.
 a. Raise valve ports of cylinder head to strong light source. If light is visible around edges of seats, then move to step 2 to recondition cylinder head.
 b. Fill ports at top of cylinder head with solvent. Wait ten full seconds and then check for leakage into combustion chamber. If solvent leakage into combustion chamber is evident, then move to step 2 to recondition cylinder head.
2. See Figure 3-80. Secure cylinder head for service.
 a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) (1) into cylinder head (2) spark plug hole.
 b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.

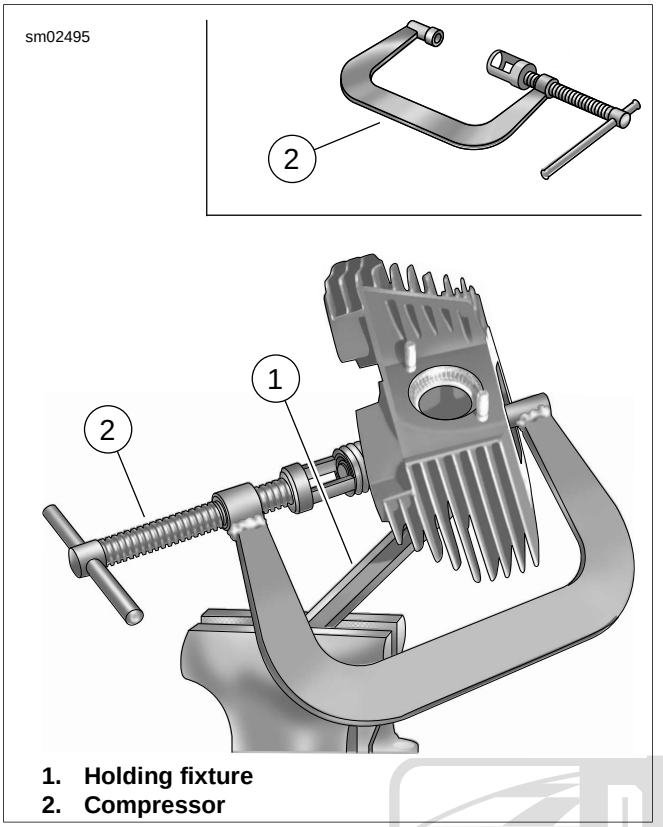


1. Holding fixture
2. Cylinder head
3. 12 mm end of fixture

Figure 3-80. Cylinder Head Holding Fixture

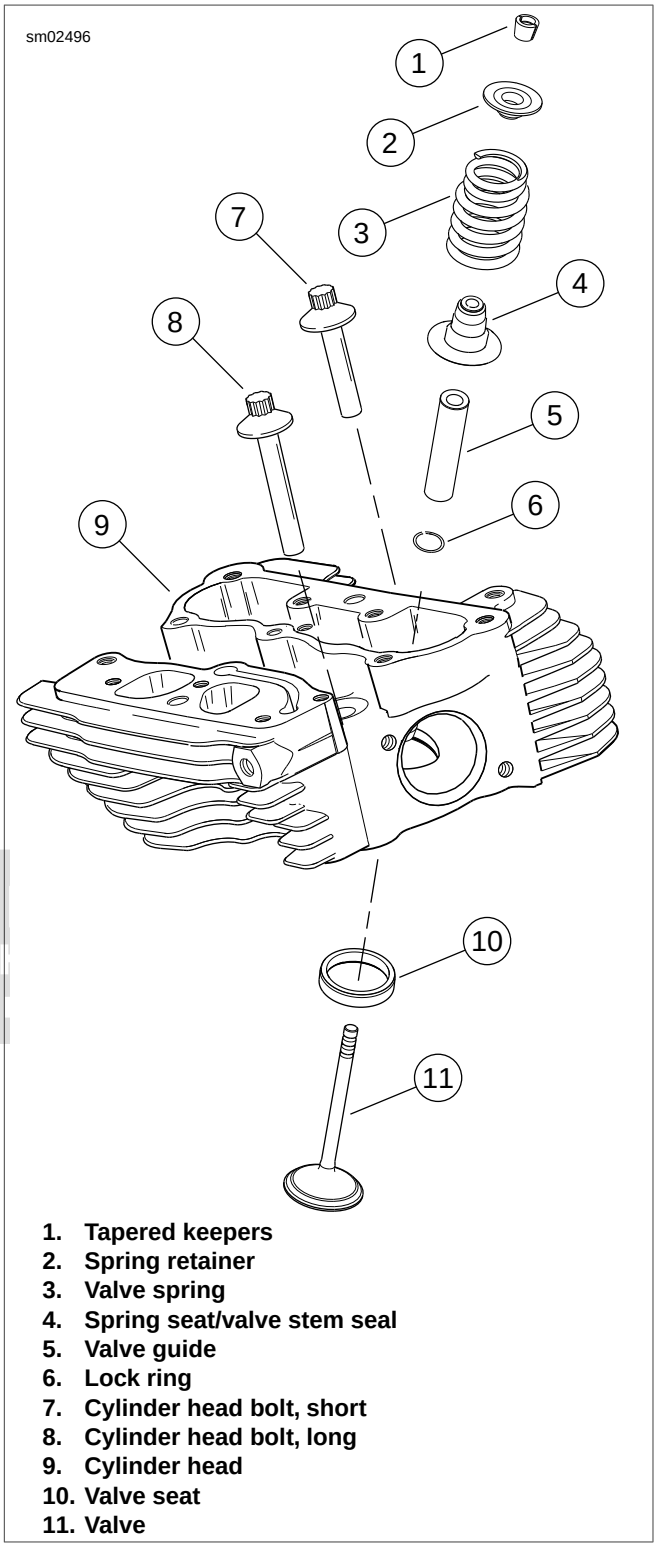
3. See Figure 3-81. Release valve spring compression.
 a. Place VALVE SPRING COMPRESSOR (Part No. HD-34736-B) (2) over cylinder head. Center blunt end on the valve head. Seat adapter at end of forcing screw on the valve spring retainer.
 b. Rotate forcing screw to compress valve spring.
 c. See Figure 3-82. If spring retainer (2) has not broken free of tapered keepers (1), give head of tool a sharp tap with a soft mallet. Using magnetic rod or small screwdriver, remove the keepers (1) from the valve stem (11) groove.
 d. Rotate forcing screw to release the valve spring compression.
4. Remove the spring retainer (2) and valve spring (3).
5. Slide the valve (11) from the valve guide (5).
6. Remove valve seal assembly.
7. Mark the bottom of the valve F(ront) or R(ear) for identification. Also, separate and tag tapered keepers, valve spring and spring retainer so that they are installed on the same valve at time of assembly.
8. Repeat steps 3-7 to remove the other valve components.

9. Release the cylinder head holding fixture from the vise. Remove fixture tool from spark plug hole.



1. **Holding fixture**
2. **Compressor**

Figure 3-81. Valve Spring Compressor (Part No. HD-34736-B)



1. **Tapered keepers**
2. **Spring retainer**
3. **Valve spring**
4. **Spring seat/valve stem seal**
5. **Valve guide**
6. **Lock ring**
7. **Cylinder head bolt, short**
8. **Cylinder head bolt, long**
9. **Cylinder head**
10. **Valve seat**
11. **Valve**

Figure 3-82. Cylinder Head Assembly

CLEANING

1. See Figure 3-82. Remove old gasket material from cylinder head (9). Gasket material left on sealing surfaces will cause leaks.

CAUTION

Do not use glass or sand to bead blast surfaces exposed to engine oil. Blasting materials can lodge in pores of the casting. Heat expansion releases this material which can contaminate oil resulting in engine damage. (00534b)

NOTE

Bead blasting materials could also enter threaded holes adversely affecting fastener engagement and torque indication. Cover all threaded holes before bead blasting.

2. Remove all carbon deposits from combustion chamber and machined surfaces of cylinder head. Exercise caution to avoid removing any metal material. For best results, use an air tool with a **worn** wire brush. Scraping may result in scratches or nicks.
3. To soften stubborn deposits, soak the cylinder head in a chemical solution, such as GUNK HYDRO-SEAL or other carbon and gum dissolving agent. Repeat step 2 as necessary.
4. Thoroughly clean the cylinder head, spring retainers, tapered keepers, valves and valve springs in a non-volatile cleaning solution or solvent. Follow up with a thorough wash in hot soapy water.

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

5. Blow parts dry with low pressure compressed air.

INSPECTION

PART NUMBER	TOOL NAME
B-45525	VALVE GUIDE HONE
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-42324-A	CYLINDER TORQUE PLATES
HD-96796-47	VALVE SPRING TESTER

Cylinder Head

1. Check for scratches and nicks on all gasket sealing surfaces.
2. Check for warpage.
 a. With the combustion chamber side facing upward, set a straightedge diagonally across the length of the cylinder head intersecting the upper and lower corners of the gasket surface.
 b. Slide a feeler gauge beneath the straightedge to check the head for warpage.
 c. Checking the opposite diagonal, repeat the procedure to verify that the gasket surface is flat (especially if a head gasket was blown). Discard the head if any low spot is 0.006 in. (0.152 mm) or greater.

NOTE

For best results, use one of the CYLINDER TORQUE PLATES (Part No. HD-42324-A) in lieu of the straightedge. Lay the upper plate (without vise grip) flat on the machined surface of the head. As a preliminary check, see if the plate rocks from side to side. A head on which the plate rocks is immediately suspect. Insert a feeler gauge between the plate and head at various locations to see if warpage exceeds above specification.

3. Verify that oil passageways are open and clean.

Valve Guides

1. Inspect external surfaces, particularly the combustion chamber side, for cracks. Replace the guide if any cracks are found.
2. Prepare valve guides for inspection.
 a. Lightly hone bore using the VALVE GUIDE HONE (Part No. B-45525).
 b. Scrub with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) to remove any dust or debris.
 c. Polish the valve stem with fine emery cloth or steel wool to remove carbon buildup.
3. Check valve stem to guide clearance:
 a. Carefully measure the **inside** diameter of the valve guide using an inside ball micrometer.
 b. Measure the **outside** diameter of the valve stem with an outside micrometer.
 c. Refer to Table 3-34. If the clearance between stem and guide exceeds the limits shown, the valve stem and/or guide are excessively worn.
 d. Repeat measurements with a **new** valve to determine if the guide must be replaced.

Table 3-34. Valve Stem to Guide Clearance Service Wear Limits

VALVE	IN.	MM
Intake	0.0038	0.0965
Exhaust	0.0038	0.0965

Valves

1. Replace the valve if there is evidence of burning or cracking.
2. Inspect the end of the valve stem for pitting or uneven wear. Replace the valve if either of these conditions are found.
3. Inspect for burrs around the valve stem keeper groove. Remove burrs with a fine tooth file if found.
4. To determine if the valve stem is excessively worn, see valve guide inspection.

Valve Springs

1. Inspect springs for cracked or discolored coils. Replace springs if either of these conditions are found.

2. Set the intake and exhaust valve springs on a level surface and use a straightedge to check for proper squareness and height. Too much height corresponds to a reduction in spring pressure which results in sluggish valve action.
3. Check free length of springs using a dial vernier caliper or load test with the VALVE SPRING TESTER (Part No. HD-96796-47). Replace springs if free length or compression force do not meet specifications. See 3.2 SPECIFICATIONS.

Tapered Keepers

1. Inspect parts for damage or rust pits. Replace as necessary.
2. Inspect inboard side of tapered keepers for excessive wear. Upraised center must be pronounced and fit snugly in valve stem groove. Place keepers into groove and verify that they grip tightly without sliding.

Valve Seats

1. Inspect seats for cracking, chipping or burning. Replace seats if any evidence of these conditions are found.
2. Check seats for recession by measuring valve stem protrusion. See 3.23 CYLINDER HEAD, Valve and Seat Refacing.

VALVE GUIDE REPLACEMENT

PART NUMBER	TOOL NAME
B-45523	VALVE GUIDE REAMER
B-45524-1	VALVE GUIDE DRIVER
B-45524-2A	VALVE GUIDE INSTALLER SLEEVE
B-45525	VALVE GUIDE HONE
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-39782-1	CYLINDER HEAD SUPPORT STAND
HD-39782-3	INTAKE SEAT ADAPTER
HD-39782-4	EXHAUST SEAT ADAPTER
HD-39782-B	CYLINDER HEAD SUPPORT STAND KIT
HD-39786	CYLINDER HEAD HOLDING FIXTURE
HD-39847	REAMER T-HANDLE
HD-39964	REAMER LUBRICANT

Removal

NOTES

- *If valve guide replacement is necessary, always install **new** guide before refacing valve seat.*
- *CYLINDER HEAD SUPPORT STAND KIT (Part No. HD-39782-B) ensures that valve guide and seat are perpendicular. If perpendicularity is not achieved, the cylinder head valve guide bore will be damaged during the press procedure.*

1. See Figure 3-83. Prepare cylinder head for valve guide replacement.
 a. Obtain CYLINDER HEAD SUPPORT STAND KIT (Part No. HD-39782-B).
 b. Insert sleeve of INTAKE SEAT ADAPTER (Part No. HD-39782-3) (3) or EXHAUST SEAT ADAPTER (Part No. HD-39782-4) (4) seat adapter into tube at top CYLINDER HEAD SUPPORT STAND (Part No. HD-39782-1) (2).
 c. Position cylinder head so that valve seat is centered on seat adapter.

NOTE

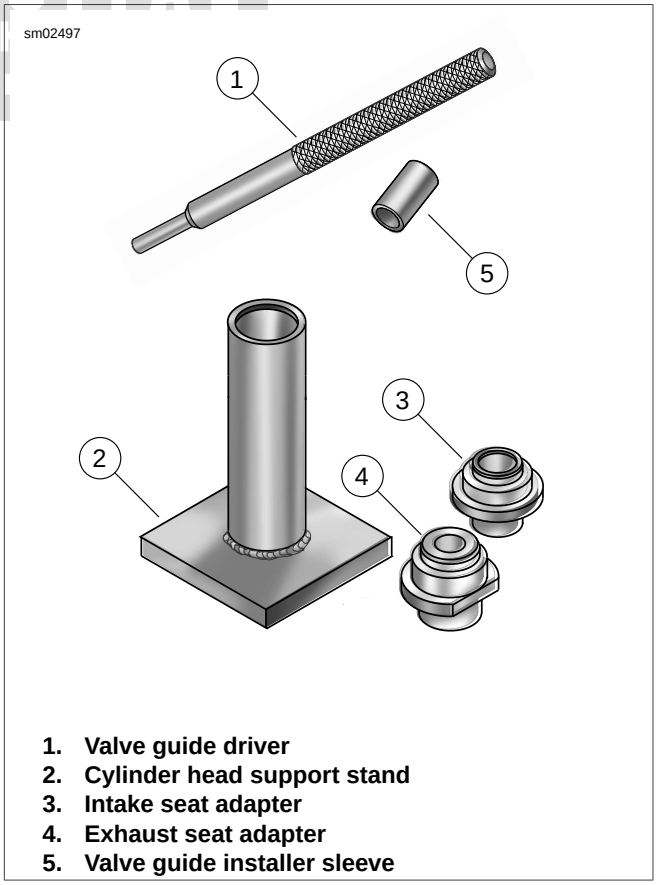
Do not press out the valve guide from the bottom of the cylinder head. Carbon buildup on the combustion chamber side of the guide can deeply gouge the cylinder head bore diminishing the likelihood of achieving the proper interference fit and possibly requiring replacement of the cylinder head casting.

2. Remove and discard lock ring from valve guide groove.

NOTE

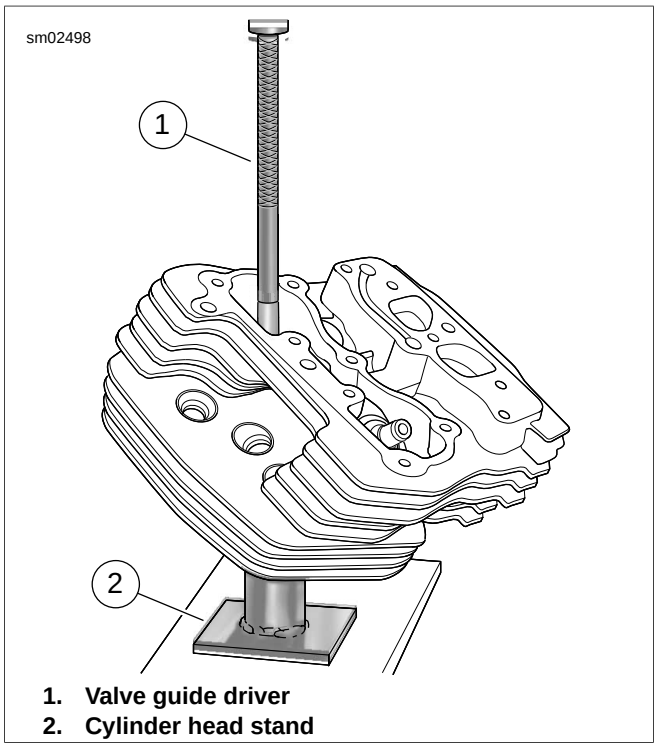
Lock ring is present on OEM intake and exhaust valve guides.

3. At top of the cylinder head, insert VALVE GUIDE DRIVER (Part No. B-45524-1) (1) into valve guide bore until stopped by shoulder.
4. See Figure 3-84. Center valve guide driver under ram of arbor press. Apply pressure until valve guide drops free of cylinder head. Discard valve guide.



1. **Valve guide driver**
2. **Cylinder head support stand**
3. **Intake seat adapter**
4. **Exhaust seat adapter**
5. **Valve guide installer sleeve**

Figure 3-83. Valve Guide Replacement Tools



1. **Valve guide driver**
2. **Cylinder head stand**

Figure 3-84. Remove Valve Guide

Installation

1. Check valve guide to valve bore clearance.
 a. Measure the outside diameter of a new standard valve guide.
 b. Measure the cylinder head valve guide bore. The valve guide should be 0.0020-0.0033 in. (0.051-0.084 mm) larger than the bore.
 c. If clearance is not within specification, then select one of the following oversize guides: 0.001 in. (0.025 mm), 0.002 in. (0.05 mm) or 0.003 in. (0.08 mm).

NOTE

Since some material is typically removed when the guide is pressed out, it is normal to go to the next larger size for the proper interference fit.

2. Measure cylinder head bore and outside diameter of selected oversize guide to verify correct interference fit.

NOTE

Support stand ensures that valve guide and seat are perpendicular. If perpendicularity is not achieved, cylinder head valve guide bore will be damaged during the press procedure.

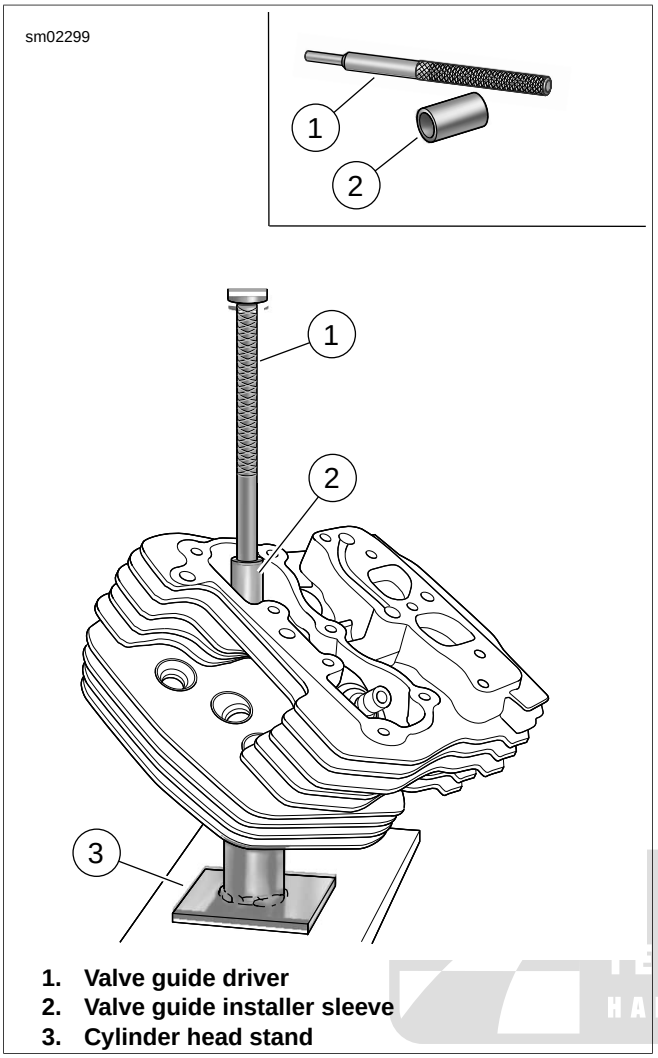
3. Prepare cylinder head for valve guide replacement.
 a. See Figure 3-83. Insert sleeve of INTAKE SEAT ADAPTER (Part No. HD-39782-3) (3) or EXHAUST SEAT ADAPTER (Part No. HD-39782-4) (4) into tube at top of support stand (2). Position cylinder head so that valve seat is centered on seat adapter.
 b. Apply Vaseline to lightly lubricate external surfaces of valve guide. Spread lubricant so that thin film covers entire surface area.
 c. At top of cylinder head, start valve guide into bore.
 d. See Figure 3-85. Place VALVE GUIDE INSTALLER SLEEVE (Part No. B-45524-2A) (2) over valve guide and then insert tapered end of valve guide driver (1) into sleeve.
 e. Center valve guide driver under ram of arbor press and apply pressure only until valve guide is started in bore and then back off ram slightly to allow guide to center itself.

NOTE

Always back off ram to allow the valve guide to find center. Pressing guide into cylinder head in one stroke can bend driver, break guide, distort cylinder head casting and/or damage cylinder head valve guide bore.

 f. Verify that support stand (3) and driver (1) are square. Center driver under ram and press valve guide further into bore, but then back off ram again to allow valve guide to find center.
 g. Repeat previous step and then apply pressure to driver until installer sleeve contacts machined area of cylinder head.
 h. Install **new** lock ring into valve guide groove. Verify that lock ring is square and fully seated in the groove.

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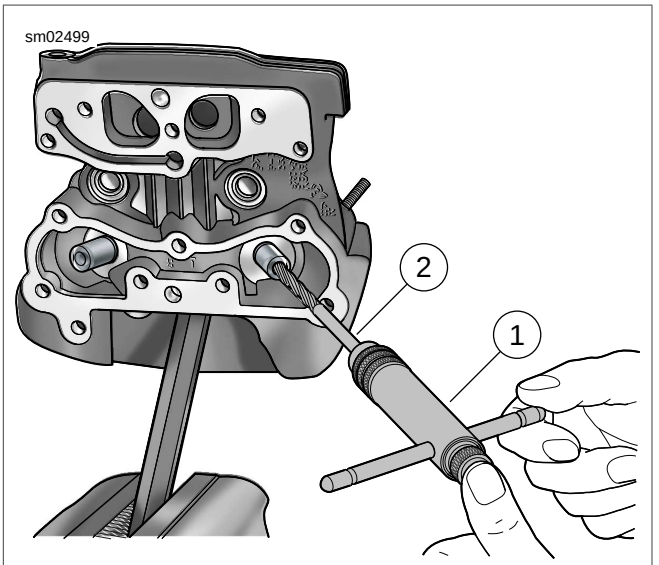
1. **Valve guide driver**
2. **Valve guide installer sleeve**
3. **Cylinder head stand**

Figure 3-85. Install Valve Guide

4. Secure cylinder head for service.
 a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
 b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.

NOTE

Valve guides must be reamed to within 0.0005-0.0001 in. (0.013-0.0025 mm) of finished size.



1. **T-handle**
2. **Valve guide reamer**

Figure 3-86. Reaming Valve Guide Bore

5. See Figure 3-86. Obtain the VALVE GUIDE REAMER (Part No. B-45523), REAMER T-HANDLE (Part No. HD-39847) and REAMER LUBRICANT (Part No. HD-39964).
 a. Install T-handle (1) on reamer (2).
 b. Apply a liberal amount of reamer lubricant to valve guide bore and bit of reamer. Start bit of reamer into bore at top of cylinder head.
 c. Placing thumb on drive socket of reamer T-handle, apply slight pressure on reamer while rotating in a clockwise direction. Squirt additional lubricant onto reamer and into guide as necessary.

NOTE

For best results, do not push on reamer or apply pressure to the reamer handle. While excessive pressure results in a rough cut, bore will be tapered if pressure is not centrally applied.

 d. Continue rotating reamer T-handle until entire bit has passed through valve guide bore and shank of reamer rotates freely.
 e. Remove T-handle from reamer, and carefully pulling on bit, draw shaft of reamer out combustion chamber side of valve guide.

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

6. Direct compressed air into the valve guide bore to remove any metal shavings or debris.
7. See Figure 3-87. Clean valve guide bore with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).

8. See Figure 3-88. Obtain the VALVE GUIDE HONE (Part No. B-45525) and REAMER LUBRICANT (Part No.HD-39964).
 a. Install hone in a high speed electric drill.
 b. Apply reamer lubricant to finishing stones of hone and valve guide bore.
 c. Start finishing stones of hone into bore.
 d. Activating the drill, move the entire length of the finishing stone arrangement forward and backward through the bore for 10 to 12 complete strokes. Work for a crosshatch pattern of approximately 60°.
9. Direct compressed air into the valve guide bore to remove any debris. Clean with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).

NOTE

Always verify valve stem to valve guide clearance after honing, since a worn reamer may cut the bore undersize.

10. Check valve stem to valve guide clearance.
 a. Measure the inside diameter of the valve guide with an inside ball micrometer.
 b. Measure the outside diameter of the valve stem with an outside micrometer.
 c. Refer to Table 3-35. If the clearance between stem and guide is not within the limits shown, the low end being preferable, then the valve stem may be excessively worn or the valve guide bore undercut.

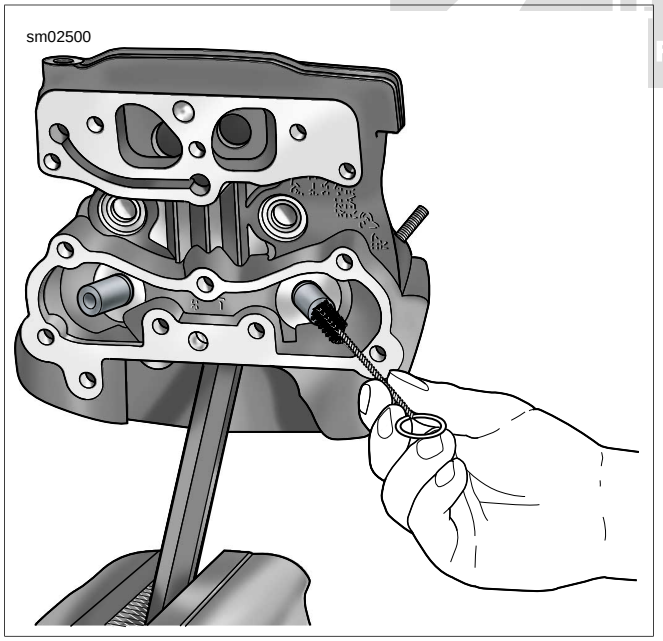


Figure 3-87. Scrubbing Valve Guide Bore

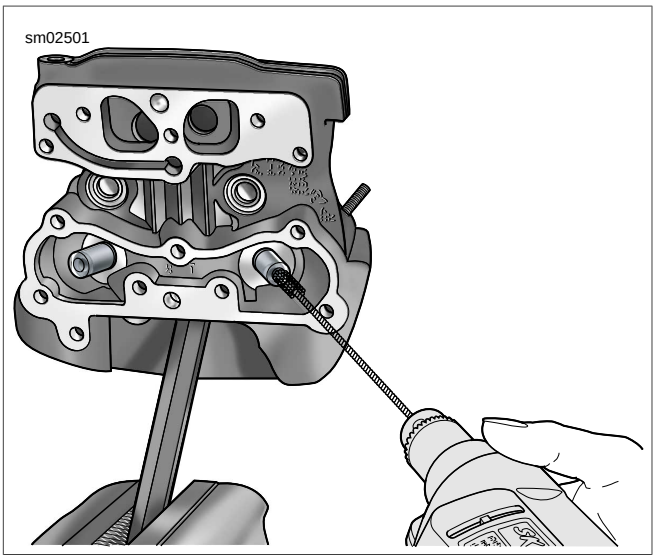


Figure 3-88. Honing Valve Guide Bore

11. Clean cylinder head assembly again.
 a. Using cleaning solvent, thoroughly clean cylinder head and valve guide bore.
 b. Scrub valve guide bore with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751). For best results, use a thin engine oil and clean valve guide bore with the type of swabs or patches found in gun cleaning kits.
 c. Continue to wipe bore until clean cloth shows no evidence of dirt or debris. Follow up with a thorough wash in hot soapy water.

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

12. Blow parts dry with low pressure compressed air.

Table 3-35. Valve Stem to Guide Clearance

VALVE	IN.	MM
Intake	0.001-0.003	0.0254-0.0762
Exhaust	0.001-0.003	0.0254-0.0762

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VALVE AND SEAT REFACING

PART NUMBER	TOOL NAME
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-35758-C	NEWAY VALVE SEAT CUTTER SET
HD-39786	CYLINDER HEAD HOLDING FIXTURE

NOTES

- *Verify correct valve stem to valve guide clearance before refacing. Refer to Table 3-35. If **new** guides must be installed, complete that task before refacing valve seats.*
- *This procedure is not based on the lapping of valves. The end result is an interference fit between the 45° valve face and the valve seat which will be 46°.*

1. Hold the valve firmly against a wire wheel in a bench grinder. Remove all carbon deposits from the valve head, face and stem, but exercise caution to avoid removing any metal. Carbon left on the stem may affect alignment in the valve refacer. Polish the valve stem with steel wool or crocus cloth to remove any marks that might be left by the wire wheel.
2. Install valve (both intake and exhaust) in a valve refacer set to a 45° angle. The valve refacer is required equipment, since accuracy in matching the angle of the valve face with the angle of the valve seat is critical.

NOTES

- *Do not remove any more metal than is necessary to clean up and true the valve face. Removing metal reduces the service life of the valve. The amount of grinding needed to retrue the valve is a clear indication of its condition. Discard the valve if it cannot be quickly refaced while maintaining a good margin. See Figure 3-91. Valves that do not clean up quickly are either warped, excessively worn or too deeply pitted to be used.*
- *Obtain a **new** valve if grinding leaves the margin less than 0.0313 in (0.795 mm). A valve in this condition does not seat normally, burns easily and may crack or cause pre-ignition.*

3. Wipe valve seats and valve faces clean. From the bottom of the cylinder head, insert the valve stem into the valve guide. Push on head of valve until it contacts the valve seat.
4. See Figure 3-89. Measure valve stem protrusion. Seat wear causes the valve stem protrusion to change.
 a. Placing finger at bottom of valve to keep valve seated, use a dial vernier caliper to check the distance from the top of the valve stem to the machined area on the cylinder head.
 b. Seat wear and valve refacing causes the valve stem protrusion to change. If protrusion exceeds 2.069 in. (52.553 mm), then replace the valve, valve seat or cylinder head as necessary.

NOTE

Do not shorten the valve by grinding on the end of the stem. Grinding replaces the hardened case with mild steel which results in accelerated wear.

5. Secure cylinder head for servicing.
 a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
 b. Clamp fixture in vise and further tighten cylinder head onto the fixture to prevent any movement during operation.
 c. Place cylinder head at a 45° angle or one that offers a comfortable working position.
6. In order to determine the correct location of the 46° valve seat in the head, measure the width of the valve to be used and subtract 0.080 in. (2.032 mm) from that number.
7. Set your dial caliper to the lesser measurement and lock down for quick reference. This is the location of your valve seat.
8. Use a permanent magic marker to highlight the valve seat area that is going to be cut. Be sure to highlight all three angles. Allow marker to dry before proceeding.

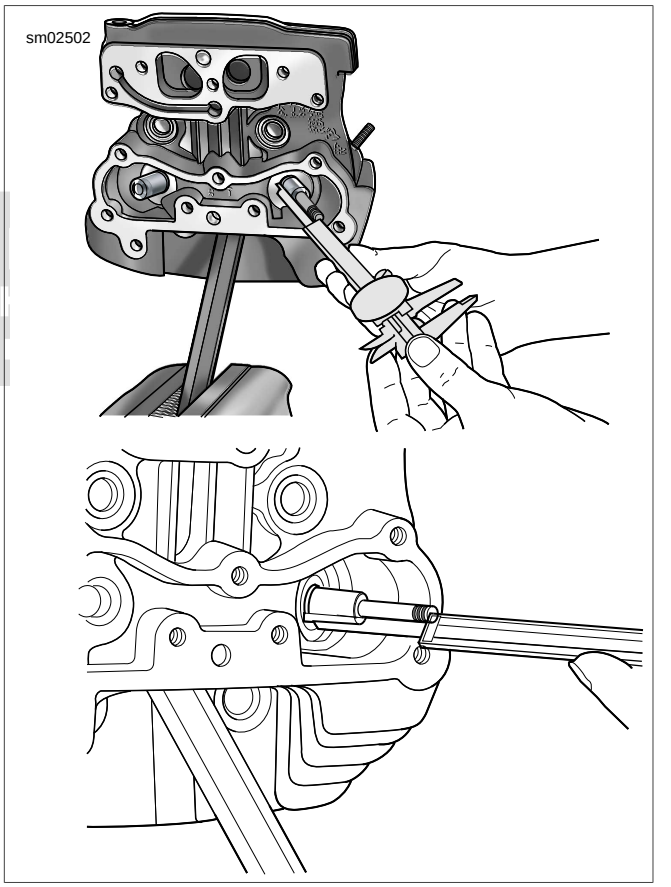


Figure 3-89. Checking Valve Stem Protrusion

NOTES

- *Always ensure cutter blades and cutter pilot are clean before beginning the cutting process. The correct cleaning brush is supplied with the Neway tool set.*
- *Always ensure the inside of the valve guide is clean by using VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).*

9. See Figure 3-90. Obtain the NEWAY VALVE SEAT CUTTER SET (Part No. HD-35758-C). Choose the cutter pilot that fits properly into the valve guide hole. Securely seat the pilot by pushing down and turning using the installation tool supplied in the tool set.
10. Choose the proper 46° cutter (intake or exhaust) and gently slide the cutter onto the pilot. Be careful not to drop the cutter onto the seat.
11. While applying a constant and consistent pressure, remove just enough material to show a complete clean-up on the 46° angle. Do not remove any more metal than is necessary to clean up the seat (that is, to provide a uniform finish and remove pitting).

NOTES

- *If the width of the clean-up angle is greater on one side of the seat than the other, the guide may need to be replaced due to improper installation.*
- *After making the 46° cut, if you discover a groove cut completely around the seat, this means the blades of the cutter are in alignment and need to be staggered. This is accomplished by loosening all of the blades from the cutter body and moving each blade slightly in its cradle in opposite directions on the cutter. The tool needed to loosen the blades is supplied in the tool set. A permanent magic marker mark every 90° will help in determining where new angles are.*

12. Next, with your dial caliper locked to the predetermined setting, measure the 46° cut at the outermost edge at the widest point of the circle to determine what cut needs to be made next.
 a. If the 46° cut is too high (towards the combustion chamber), use the 31° cutter to lower the valve seat closer to the port.
 b. If the 46° cut is too low, use the 60° cutter to raise the valve seat or move it away from the port.

NOTES

- *Because you are using the top measurement of the valve seat as a reference point it will usually be necessary to use the 31° cutter following the initial 46° cut.*
- *Always highlight the valve seat with the permanent magic marker in order to ensure the location of the 46° valve seat.*

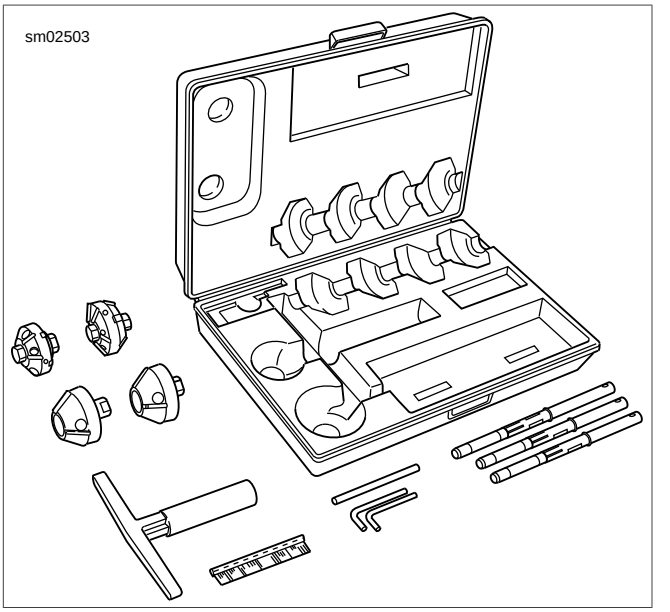


Figure 3-90. Neway Valve Seat Cutter Set

13. If the location of the valve seat is not correct, repeat steps 10 and 11.
14. When you accomplish a complete clean-up of the 46° angle and the width is at least 0.062 in. (1.575 mm), proceed to the next step.
15. Select the proper 60° cutter and gently slide the cutter down the cutter pilot to the valve seat.
16. Remove just enough material to provide an even valve seat width of 0.040-0.062 in. (1.016-1.575 mm).
17. Remove cutter and cutter pilot.
18. Insert valve to be used in the valve guide and bottom on the valve seat. Positioning the cylinder head port upwards and with slight thumb pressure against the valve, completely fill the port with solvent to verify proper seal between the valve and the valve seat.

NOTE

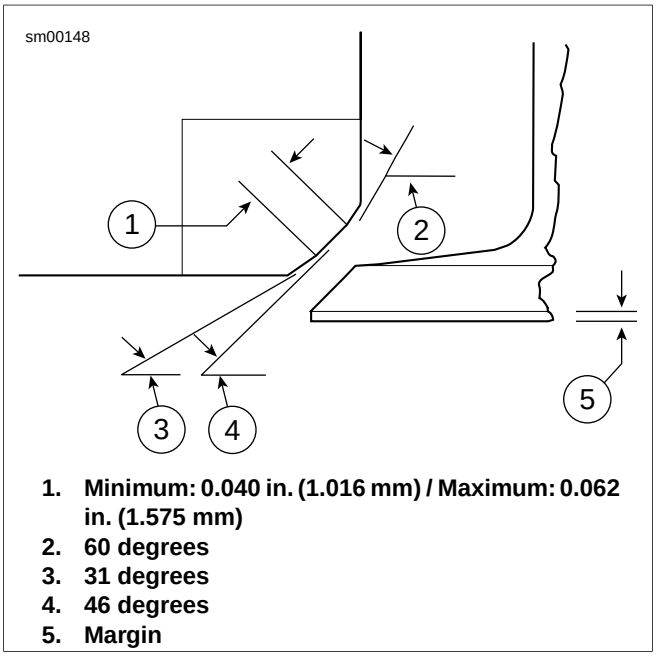
Hold pressure against the valve for a minimum of 10 seconds. If any leakage occurs, examine the valve and valve seat for irregularities or defects and if necessary repeat the above valve grinding or valve seat cutting process.

19. Repeat the process on any valve seat that needs service.
20. Clean valves, cylinder head and valve seats in solvent. Follow up with a thorough wash in hot soapy water.

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

21. Blow parts dry with low pressure compressed air.



1. **Minimum: 0.040 in. (1.016 mm) / Maximum: 0.062 in. (1.575 mm)**
2. **60 degrees**
3. **31 degrees**
4. **46 degrees**
5. **Margin**

Figure 3-91. Valve and Seat Dimensions

ASSEMBLY

PART NUMBER	TOOL NAME
HD-34736-B	VALVE SPRING COMPRESSOR
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-39786	CYLINDER HEAD HOLDING FIXTURE

1. Secure cylinder head for service.
 a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
 b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.

NOTE

At the time of disassembly, all parts should have been marked or tagged so that they are installed on the same valve (and in the same head).

2. Run the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) through the valve guide bore to verify cleanliness.
3. Using TORCO MPZ or another suitable product, apply a liberal amount of engine assembly lube to valve stem.
4. From the bottom of the cylinder head, insert the valve stem into the valve guide.
5. To distribute the assembly lube evenly around the valve stem and guide, hand spin the valve as it is installed. Work the valve back and forth in the bore to verify that it slides smoothly and seats properly.
6. Remove the valve and apply a second coat of assembly lube to the valve stem. Install the valve in the valve guide.

CAUTION

Failure to install plastic capsule can cause the valve stem seal to catch the edge of the valve stem keeper groove. The resulting damage can cause leakage around the valve stem, excessive oil consumption and valve sticking. (00535b)

7. See Figure 3-92. Push on bottom of valve until it contacts the valve seat. Placing finger at bottom of valve to keep valve seated, slide plastic capsule over valve stem tip and keeper groove.
8. Apply a very thin film of clean H-D 20W50 engine oil to capsule.
9. See Figure 3-93. Obtain **new** valve stem seal.
10. Slide new valve stem seal/spring seat over capsule and down valve stem until contact is made with top of valve guide and machined area of cylinder head casting. Remove capsule from valve stem tip.

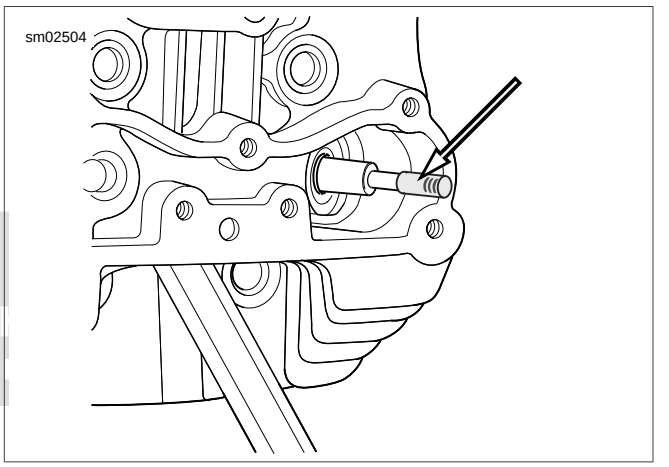


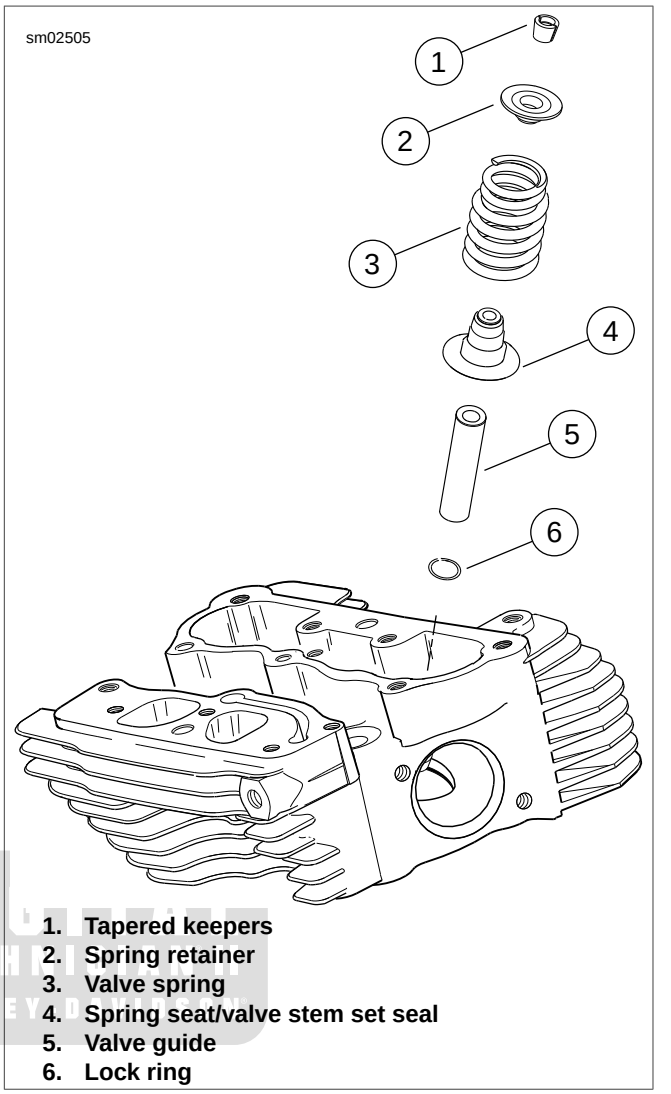
Figure 3-92. Plastic Capsule



Figure 3-93. Valve Stem Seal/Spring Seat Assembly

11. See Figure 3-94. Apply a liberal amount of assembly lube to valve stem tip and keeper groove (1).
12. With the smaller diameter coils topside, install the valve spring (3) over the valve guide (5). Place the spring retainer (2) on top of the valve spring.

13. Obtain the VALVE SPRING COMPRESSOR (Part No. HD-34736-B) and proceed as follows:
 a. Place tool over cylinder head so that the blunt end is centered on the valve head and adapter at end of forcing screw is seated on the valve spring retainer.
 b. Rotate forcing screw to compress valve spring.
 c. With the tapered side down, fit the keepers into the valve stem groove. For best results, apply a dab of grease to the inboard side of the keepers before installation and use a magnetic rod for easy placement.
 d. Arranging tapered keepers so that the gaps are evenly spaced, turn forcing screw to release valve spring compression.
14. Tap the end of the valve stem once or twice with a soft mallet to ensure that tapered keepers are tightly seated in the valve stem groove.
15. Repeat previous steps to install the other valve components.
16. Release the cylinder head holding fixture from the vise. Remove fixture tool from spark plug hole.
17. Cover the cylinder head to protect it from dust and dirt until time of installation.



1. Tapered keepers
2. Spring retainer
3. Valve spring
4. Spring seat/valve stem set seal
5. Valve guide
6. Lock ring

Figure 3-94. Valve Assembly

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install cylinder head.
2. Install push rod covers and push rods.
3. Install rocker arm support plate.
4. Install breather assembly.
5. Continue with vehicle assembly as directed.

CYLINDER 3.24

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.
5. Remove cylinder.

CLEANING

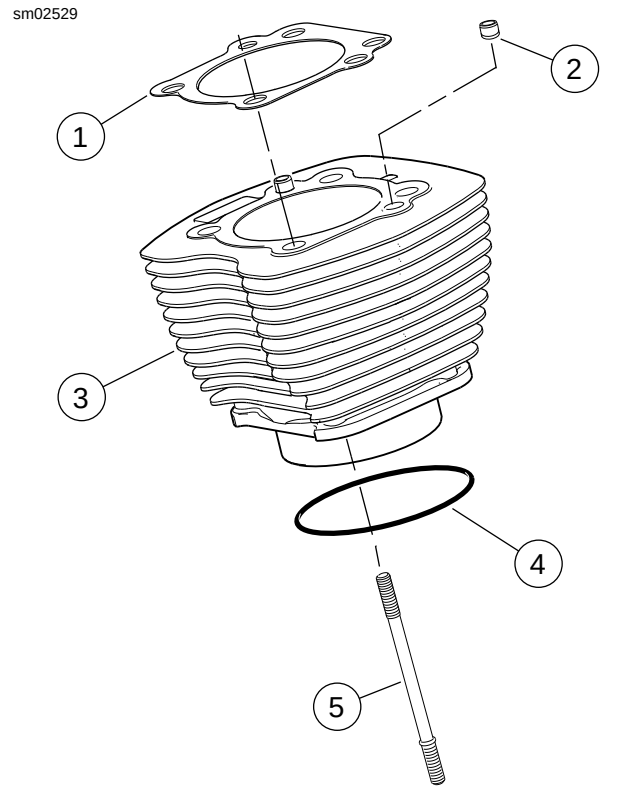
PART NUMBER	TOOL NAME
HD-42324-A	CYLINDER TORQUE PLATES

1. See Figure 3-95. Scrape old gasket material from the machined surface at the top of the cylinder (3). Old gasket (1) material left on the mating surface will cause leaks.

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

2. Clean cylinder in a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air. Verify that oil passageways are clean and open.
3. Inspect the cylinder bore for defects or damage in the ring travel area. Replace cylinders that are severely scored, scuffed, scratched, burnt or gouged.
4. Using Magnaflux Dye Penetrant, inspect the cylinder for cracks. If no cracks are found, thoroughly wash cylinder to remove traces of dye.
5. Use a file to carefully remove any nicks or burrs from the machined surfaces of the cylinder.
6. See Figure 3-96. Check the machined surfaces for flatness using a feeler gauge and CYLINDER TORQUE PLATES (Part No. HD-42324-A) as follows:
 a. Lay gasket side of the upper torque plate (3) (without vise grip step) flat against the head gasket surface of the cylinder.
 b. As a preliminary check, see if the plate rocks from side to side. A cylinder on which the plate rocks is immediately suspect.
 c. Insert a feeler gauge between the plate and cylinder at various locations.
 d. The head gasket surface must be flat within 0.006 in. (0.15 mm).
 e. Now turn the cylinder upside down and lay the seal side of the lower torque plate (2) (with vise grip step) flat against the o-ring seal surface. Repeat steps 6b and 6c above.
 f. The o-ring seal surface must be flat within 0.004 in. (0.102 mm).
 g. Replace the cylinder (and piston) if either surface is not within specification.



1. **Cylinder head gasket**
2. **Dowel pin**
3. **Cylinder**
4. **O-ring seal**
5. **Cylinder stud**

Figure 3-95. Cylinder Assembly

INSPECTION

PART NUMBER	TOOL NAME
HD-42324-A	CYLINDER TORQUE PLATES
TA360	SNAP-ON TORQUE ANGLE GAUGE

NOTE

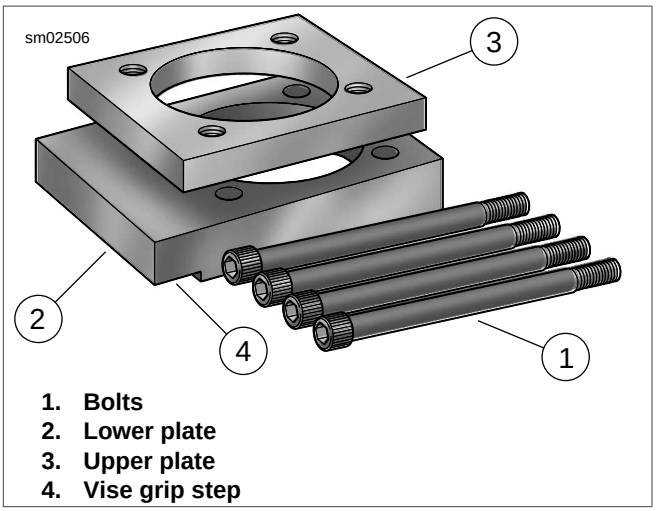
Failure to use cylinder torque plates can produce measurements that vary by as much as 0.001 in. (0.025 mm), possibly resulting in the use of parts that are not suitable for service.

1. See Figure 3-97. To simulate an assembled cylinder for accurately measuring cylinder taper and out-of-round conditions, as well as for boring, honing or deglazing, obtain the CYLINDER TORQUE PLATES (Part No. HD-42324-A). Install the torque plates as follows:
 a. Remove o-ring seal from cylinder sleeve, if installed.
 b. Place used head gasket over two dowel pins at top of cylinder.
 c. See Figure 3-97. Install brass jaws or shop towels around teeth of vise to prevent damage to tool. Clamp stepped side of lower plate in vise with the simulated split line (machined strip) facing away.
 d. Lightly oil threads and shoulders of four bolts (1) with clean H-D 20W50 engine oil. Slide four bolts all the way through holes of lower plate (2).
 e. Slide cylinder down bolts with the indent in the cooling fins facing upward.
 f. With the two dowel pins and head gasket in place, align holes in upper plate with ends of bolts. Blind holes in upper plate accommodate dowel pins in cylinder. Tighten four bolts into upper plate until finger tight.
 g. See Figure 3-98. Tighten the bolts to 120-144 **in-lbs** (13.6-16.3 Nm) in the sequence shown.
 h. Following the same sequence, tighten each bolt to 15-17 ft-lbs (20.3-23.1 Nm).

NOTE

For best results use SNAP-ON TORQUE ANGLE GAUGE (Part No. TA360).

 i. Using a grease pencil, mark a straight line on one of the bolts continuing the line over onto the lower plate. Repeat step for remaining three bolts.
 j. Using the marks as a guide, turn each bolt 1/4 turn or 90°. Be sure to tighten the bolts in the sequence shown in Figure 3-98.
 k. For purposes of inspection, remove the assembly from the vise and place on bench top.



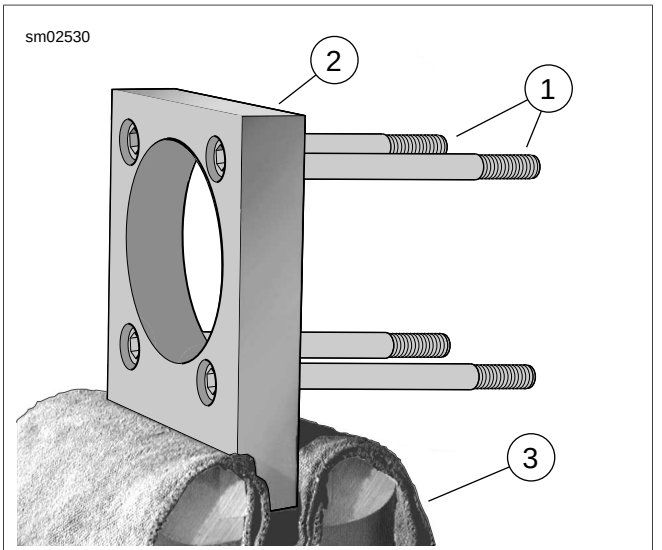
1. **Bolts**
2. **Lower plate**
3. **Upper plate**
4. **Vise grip step**

Figure 3-96. Cylinder Torque Plates (Part No. HD-42324-A)

NOTE

Maximum cylinder wear occurs at the very top of top ring travel. Minimum wear occurs below ring travel. Failure to measure the cylinder at these points may result in a faulty decision regarding the suitability of the cylinder for continued use.

2. See Figure 3-99. Using an inside micrometer or dial bore gauge, check cylinder bore for out-of round and taper. Proceed as follows:
 a. At the top of the piston ring travel zone, starting about 0.50 in. (12.70 mm) or from the top of the cylinder, measure the cylinder diameter at two locations; parallel and perpendicular to the crankshaft. Record the readings.
 b. Repeat the two measurements at the center of the piston ring travel zone.
 c. Repeat the measurements again at the bottom of the bore at a point below the piston ring travel zone.
 d. Rebore the cylinder if the parallel and perpendicular measurements at either the top, middle or bottom of the bore vary by more than 0.002 in. (0.051 mm). This indicates an out-of-round condition.
 e. Rebore the cylinder if the top, middle and bottom bore diameters either parallel or perpendicular to the crankshaft vary by more than 0.002 in. (0.051 mm). This indicates excessive taper.
3. Continue with cylinder service.
 a. If cylinders are not scuffed or scored and are not worn beyond the service limits, see 3.24 CYLINDER, Deglazing Cylinder.
 b. If cylinders are worn beyond the service limits, then they must be rebored and/or honed to accept the next standard oversize piston. See 3.24 CYLINDER, Boring and Honing Cylinder.



1. **Bolt (4)**
2. **Lower plate**
3. **Vise**

Figure 3-97. Attaching Cylinder Torque Plates

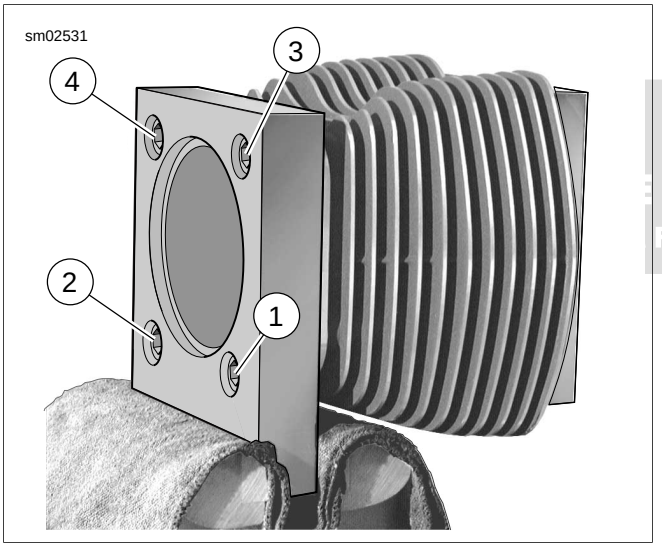


Figure 3-98. Cylinder Torque Plate Bolt Sequence

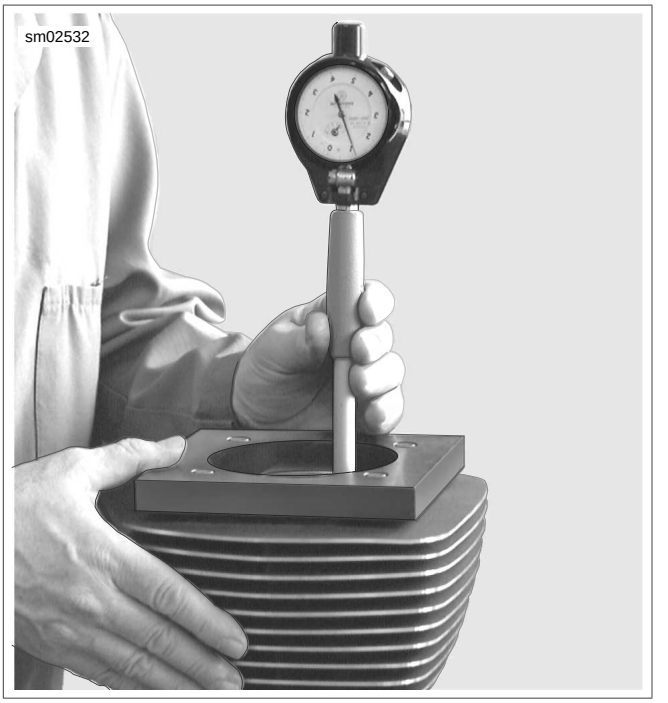


Figure 3-99. Measure for Out-of-Round and Taper

DEGLAZING CYLINDER

NOTE

Deglazing removes wear patterns, minor scuff marks and scratches without enlarging the bore diameter.

1. Lightly swab the cylinder bore with a cloth dipped in clean engine oil.
2. Obtain a 240 grit flexible ball-type deglazing tool with a bristle tip or finishing stone arrangement able to produce a 60° cross hatch pattern.
3. Install the deglazing tool in a slow-speed drill. The speed at which the tool rotates determines the speed at which it must be stroked up and down the bore to produce the desired cross hatch pattern.
4. Starting at the bottom of the cylinder, move the deglazing tool up and down the entire length of the cylinder bore for 10 to 12 complete strokes.
5. Stop to examine the cylinder bore and/or take measurements. A precise 60° cross hatch pattern in the piston travel area is the most important.

CAUTION

The angular cross hatch pattern ensures an even flow of oil onto the cylinder walls and promotes longer cylinder, piston and ring life. An incorrect cross hatch pattern will result in insufficient oil retention and possible piston seizure and/or high oil consumption. (00536b)

CAUTION

Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537b) .

6. Thoroughly wash the cylinder bore with liquid dishwashing soap and warm water to remove all abrasive particles and residual grit. Continue cleaning until a clean cloth shows no evidence of dirt or debris.
7. Hot rinse the cylinder and dry with moisture free compressed air. Immediately apply a thin film of clean engine oil to a clean white paper towel and thoroughly wipe the inside of the cylinder to prevent the cylinder bore from rusting.

NOTE

After wiping the cylinder with a clean, oiled paper towel, the towel will be dark with contamination. Repeat this process using a new lightly oiled paper towel each time until the towel remains white. The cylinder is now clean.

8. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See 3.25 PISTON, Inspection.

BORING AND HONING CYLINDER

1. Bore cylinder with gaskets and torque plates attached. Refer to Table 3-36. Bore the cylinder to 0.003 in. (0.08 mm) under the desired finished size.

CAUTION

An incorrect cross hatch pattern or too fine a hone will result in insufficient oil retention and possible piston seizure and/or high oil consumption. (00538b)

2. Hone the cylinder to its finished size using a 280 grit rigid hone followed by a 240 grit flexible ball hone. Honing must be done with the torque plates attached. All honing must be done from the bottom (crankcase) end of the cylinder. Work for a 60° crosshatch pattern.
3. Stop frequently to examine the cylinder bore and/or take measurements. Remember, a precise 60° crosshatch pattern in the piston travel area is important.

CAUTION

Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537b) .

4. Thoroughly wash the cylinder bore with liquid dishwashing soap and warm water to remove all abrasive particles and residual grit. Continue cleaning until a clean cloth shows no evidence of dirt or debris.

NOTE

Example: A 0.005 in. (0.13 mm) oversize piston will have the proper running clearance with a cylinder bore size of 3.7550-3.7555 in. (95.377-95.390 mm).

5. Hot rinse the cylinder and dry with moisture free compressed air.
6. Immediately apply a thin film of clean engine oil to a clean white paper towel and thoroughly wipe the inside of the cylinder. This prevents the cylinder bore from rusting.

NOTE

After wiping the cylinder with a clean, oiled paper towel, the towel will be dark with contamination. Repeat this process using a new lightly oiled paper towel each time until the towel remains white. The cylinder is now clean.

7. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See 3.25 PISTON, Inspection.

Table 3-36. Oversize Pistons/Cylinder Bores

PISTON			CYLINDER BORE FINISHED SIZE	
SIZE	IN.	MM	IN.	MM
Standard	N/A	N/A	3.7500-3.7505	95.250-95.263
Oversize	0.005	0.13	3.7550-3.7555	95.377-95.390
	0.010	0.25	3.7600-3.7605	95.504-95.517

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install cylinder.
2. Install cylinder head.
3. Install push rod covers and push rods.
4. Install rocker arm support plate.
5. Install breather assembly.
6. Continue with vehicle assembly as directed.

PISTON 3.25

REMOVAL OVERVIEW

NOTE

Do not use 2006 and earlier connecting rods with 2007 and later pistons. 2007 and later pistons have a tapered wrist pin boss. The wrist pin portion of the 2007 and later connecting rod is tapered to match the boss on the piston.

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.
5. Remove cylinder.
6. Remove piston.

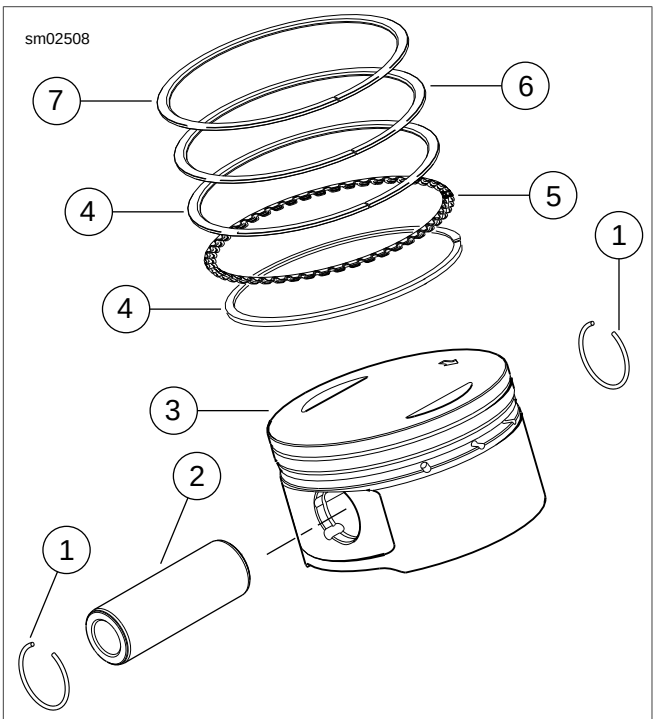
DISASSEMBLY

Piston Rings

WARNING

Wear safety glasses or goggles when removing or installing compression rings. Compression rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00469c)

1. See Figure 3-100. Carefully remove top (7) and second (6) compression rings using the proper piston ring expander (Snap-on PRS8).
2. Using your fingers, remove top and bottom oil rails (4) from the third ring groove. Remove the oil rail expansion ring (5).
3. Discard the piston rings.



1. **Circlip**
2. **Piston pin**
3. **Piston**
4. **Oil rail**
5. **Expansion ring**
6. **Second compression ring**
7. **Top compression ring**

Figure 3-100. Piston Assembly

CLEANING

1. To remove all carbon and combustion deposits, soak the pistons in a special detergent that will not corrode aluminum. Maintain the temperature of the cleaning solution well below 212° F (100° C).

NOTE

Do not sand blast or glass bead blast pistons. Bead blasting rounds off ring lands and will result in oil contamination leading to accelerated wear.

WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

2. Thoroughly rinse the pistons. Blow parts dry with moisture free compressed air.
3. Clean the oil drain holes leading from the oil control ring groove to the underside of the piston crown. Run a small bristle brush through the passageways to ensure their

cleanliness, but be careful not to damage or enlarge the holes. Do not use a wire brush.

4. Verify that all other oil holes are clean and open.

NOTE

Exercise care to avoid scratching the sides of the piston ring grooves.

5. Thoroughly clean the three piston ring grooves of all carbon deposits. A broken compression ring properly ground to a sharp chisel-like edge may be used for this purpose.

6. Using Magnaflux Dye Penetrant, inspect the piston for surface cracks. Pay special attention to the area around the pin bores, ring lands and oil drain holes beneath the piston crown. If no cracks are found, thoroughly wash piston to remove traces of dye.

INSPECTION

1. See Figure 3-101. Check piston pin.
 a. Lightly oil a good piston pin and insert it into the piston pin bore to feel for the proper interference fit. The pin should slide in and out without binding, but also without pivoting or rocking.
 b. Replace piston and/or pin if clearance exceeds 0.0008 in. (0.02 mm).

NOTE

Pistons with superficial wear marks, minor scratching or mild scoring may continue to be used.

2. Carefully inspect the pistons for damage or excessive wear.
 a. Discard pistons with cracked, broken or bent ring lands.
 b. Check the piston skirt for cracks, gouges, deep scratches or heavy scoring.
 c. Check the piston heads for evidence of burning, etching or melting.
 d. Look for marks or imprints caused by contact with valves.

3. Run your index finger around the edge of the piston crown to feel for dings, nicks or burrs. Lightly file the edge of the crown to remove any defects.

NOTE

Worn ring grooves result in high oil consumption and blow-by of exhaust gases. Blow-by of exhaust gases contaminates the engine oil supply with acids and leaves sludge in the crankcase. It also reduces engine efficiency by weakening the combustion seal necessary for efficient transfer of energy to the piston.

4. See Figure 3-102. Measure piston ring side clearance.
 a. Insert the edge of a **new** ring into the piston ring groove. Insert a feeler gauge between the upper surface of the ring and the ring land.
 b. Since the grooves wear unevenly, repeat this check at several locations around the piston groove circumference.
 c. Discard the piston if the side clearance of either compression ring exceeds 0.0045 in. (0.11 mm).
 d. Discard the piston if the oil control ring side clearance exceeds 0.010 in. (0.25 mm).

NOTES

- *Check the piston clearance in the cylinder in which the piston will run. The torque plates must be installed on the cylinder and it must be deglazed and suitable for continued service.*
- *This inspection is very heat sensitive. Do not check piston running clearance immediately after honing or deglazing cylinder. Even holding the piston in your hand for too long can cause measurements to vary by as much as 0.0002 in. (0.0051 mm). Both piston and cylinder must be at room temperatures before proceeding.*
- *Piston measurement is taken on the bare aluminum to avoid measuring errors. An oval-shaped opening is present on each side of the piston for proper placement of the micrometer. See upper frame of Figure 3-103. The oval openings are too small for a standard flat anvil micrometer which would result in measuring errors. Use a 3-4 inch blade or ball anvil style micrometer, or a 4-5 inch micrometer with spherical ball anvil adapters. See lower frame of Figure 3-103.*

5. See Figure 3-103. Measure running clearance of pistons as follows:
 a. Holding outside micrometer, measure piston skirt diameter across the thrust faces (perpendicular to piston pin bore). Start below the bottom ring land and move micrometer towards bottom of skirt. Micrometer will be loose, then tight, about 0.5 in. (12.7 mm), from bottom and then loose again.
 b. Measure the piston skirt at the tightest spot and then transfer that measurement to dial bore gauge.
 c. Using a grease pencil, mark the top, middle and bottom of the piston ring travel zone in the cylinder bore. Measure at markings in cylinder parallel and perpendicular to crankshaft.
 d. Replace piston and/or cylinder if running clearance exceeds 0.003 in. (0.076 mm).



1. Pin must slide without binding or pivoting

Figure 3-101. Piston Pin Clearance

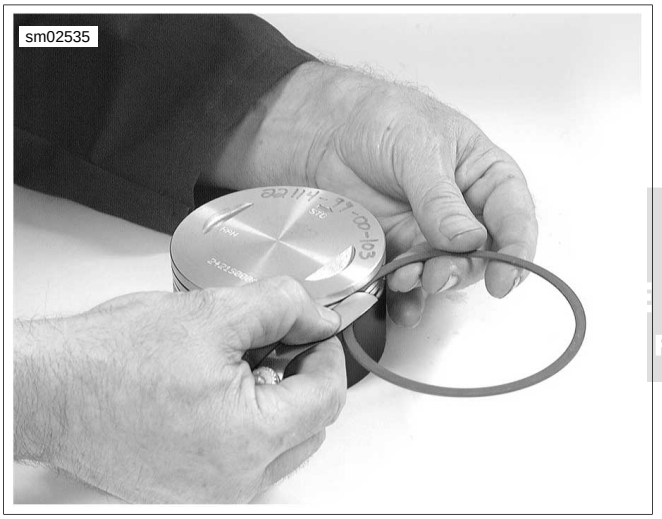
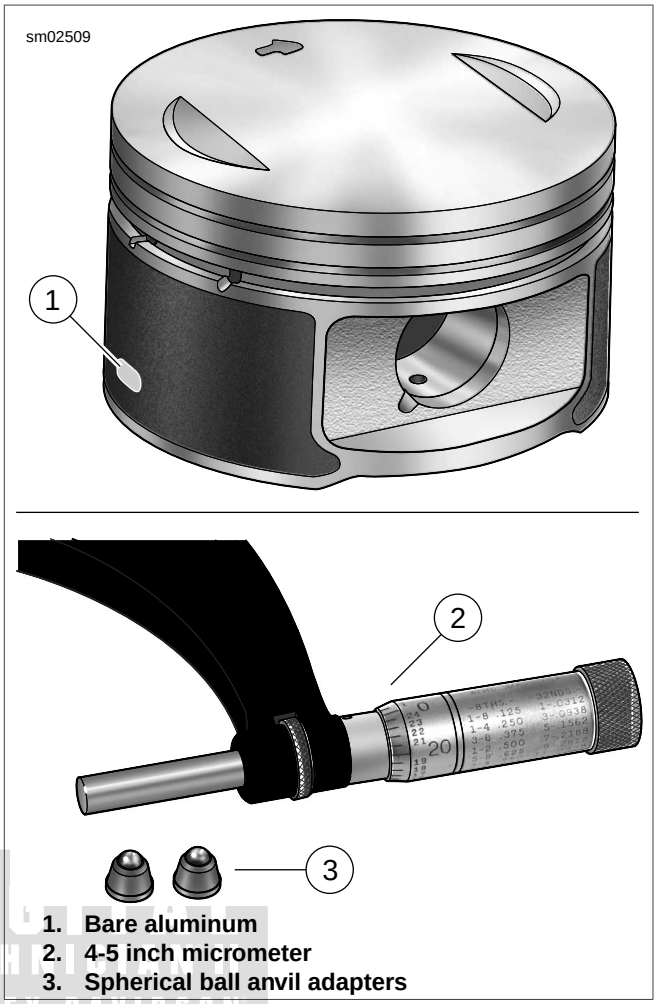


Figure 3-102. Measure Piston Ring Side Clearance



1. Bare aluminum
2. 4-5 inch micrometer
3. Spherical ball anvil adapters

Figure 3-103. Measuring Running Clearance of Piston

ASSEMBLY

Checking Piston Ring Gap

NOTES

- *Always use **new** piston rings. Piston rings take a definite set and must not be reused if the engine has been operated. Always deglaze (or hone) the cylinder before installing **new** rings. Ring sets are available to fit oversize pistons.*
- *Insufficient ring gap may cause the ends to abut at engine operating temperatures, resulting in ring breakage, cylinder scuffing and/or piston seizure.*
- *Excessive ring gap results in high oil consumption and blow-by of exhaust gases. While blow-by contaminates the oil supply and leaves sludge in the crankcase, it also reduces engine efficiency by weakening the combustion seal necessary for efficient transfer of energy to the piston.*

1. See Figure 3-104. Check ring gap before placing each ring on the piston.
 a. Insert the **new** ring into the cylinder and square it in the bore using the top of the piston. Measure the ring gap with a feeler gauge.
 b. Top compression ring gap must be 0.010-0.020 in. (0.25-0.51 mm).
 c. Second compression ring gap must be 0.014-0.024 in. (0.36-0.61 mm).
 d. Oil control rail gap must be 0.010-0.050 in. (0.25-1.27 mm).

NOTE

Ring end gap dimensions also apply to oversize rings. Replace ring if end gap exceeds specification. If end gap is under specification, filing is permissible.

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

2. Use compressed air to remove any dirt or dust that may have settled in the oil drain holes and piston ring grooves.



Figure 3-104. Measuring Ring Gap

Installing Piston Rings

1. See Figure 3-105. Apply clean H-D 20W50 engine oil to three piston ring grooves.
2. Install expansion ring (4) into third ring groove.
3. Spiral bottom oil rail (5) into space below expansion ring (4). Position gap 90° from the gap in the expansion ring.
4. Spiral top oil rail (3) into space above expansion ring (4). Position gap 180° from the gap in the bottom oil rail.

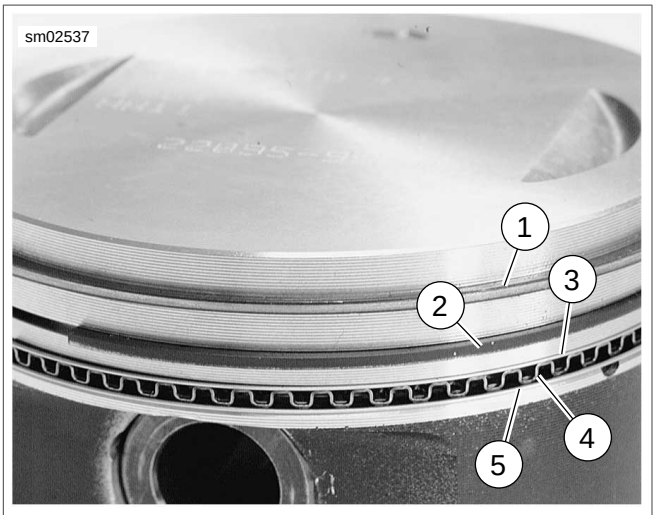
⚠WARNING

Wear safety glasses or goggles when removing or installing compression rings. Compression rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00469c)

NOTES

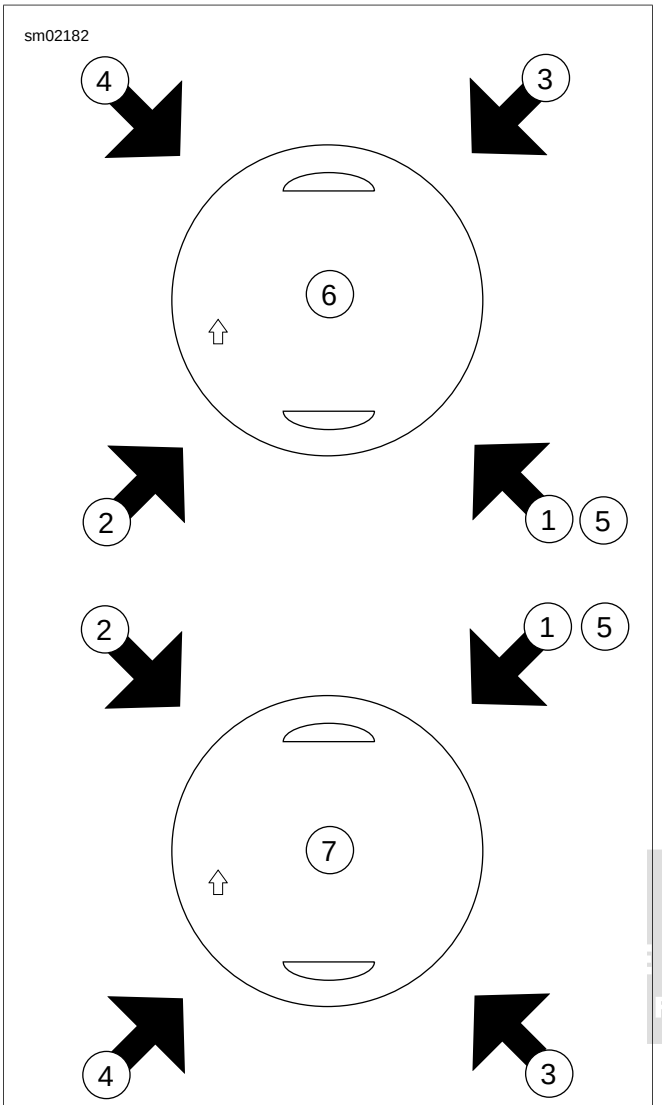
- *Use the proper piston ring spreader to prevent excessive ring twist and expansion. Over expansion may cause the ring to crack opposite the ring gap. Damaged or distorted rings result in blow-by of exhaust gases, increased oil consumption and lower service life on valves and other components.*
- *Installing the second compression ring upside down will cause oil to be scraped up into the combustion chamber resulting in excessive oil consumption and low service life on valves and other components.*

5. Using the proper piston ring expander (Snap-on PRS8), carefully install the second compression ring. Make sure the dot (punch mark) near the ring gap faces the piston crown. Rotate the ring so the gap is 180° from the gap in the expansion ring.
6. Using the proper piston ring expander (Snap-on PRS8), carefully install the top compression ring. Make sure the dot (punch mark) near the ring gap faces the piston crown. Rotate the ring so the gap is 180° from the gap in the second compression ring.
7. Rotate the three piston rings using the palms of both hands. The rings must rotate freely without sticking.
8. See Figure 3-106. Verify the ring gaps are still properly staggered.



1. **Top compression ring**
2. **Second compression ring**
3. **Top oil rail**
4. **Expansion ring**
5. **Bottom oil rail**

Figure 3-105. Piston Rings



1. **Expander ring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**
6. **Front**
7. **Rear**

Figure 3-106. Piston Ring Gap Alignment

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

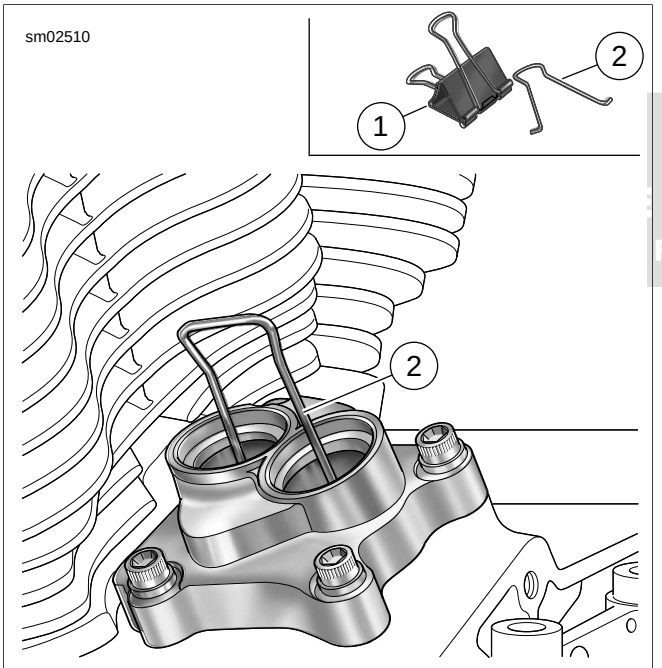
1. Attach piston to connecting rod.
2. Install cylinder.
3. Install cylinder head.
4. Install push rod covers and push rods.
5. Install rocker arm support plate.
6. Install breather assembly.
7. Continue with vehicle assembly as directed.

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CAM SUPPORT PLATE AND COVER 3.26

REMOVAL OVERVIEW

1. See 3.16 TOP END OVERHAUL: DISASSEMBLY.
 a. Remove breather assembly.
 b. Remove rocker arm support plate.
 c. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
2. See Figure 3-107. Fashion lifter holding tool to prevent the hydraulic lifters from dropping into the cam compartment during cam support plate removal.
 a. Obtain a large binder clip (1) which is available at any office supply store. Squeeze wireforms (2) to remove from binder clip.
 b. Compress wireform (2) slightly and insert free ends into outer and inner lifter cover bores so that legs engage walls of both hydraulic lifter sockets.
3. To remove cover and cam support plate, see 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.



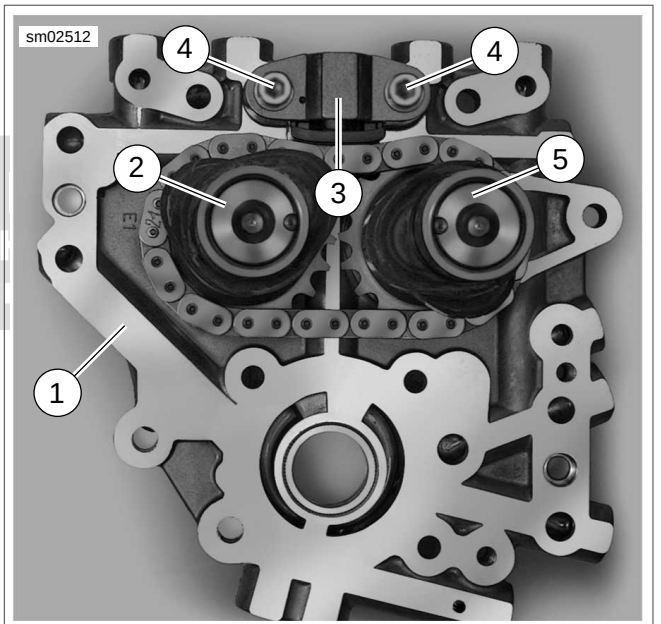
1. **Binder clip**
2. **Wireform**

Figure 3-107. Hydraulic Lifter Holding Tool

WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

2. Remove retaining ring from groove at end of front camshaft. Discard retaining ring.
3. Remove spacer from front camshaft. Do not mix front and rear camshaft spacers. Front spacer is 0.100 in. (2.54 mm) thick.
4. Using a colored marker, mark one of the links of the secondary cam chain. Maintaining the original direction of rotation during assembly may prolong service life.
5. Slide camshafts and secondary cam chain out of cam support plate.
6. Remove secondary cam chain from cam sprockets.



1. **Cam support plate**
2. **Front cam**
3. **Secondary cam chain tensioner**
4. **Secondary cam chain tensioner fasteners**
5. **Rear cam**

Figure 3-108. Camshafts

CAMSHAFTS

PART NUMBER	TOOL NAME
HD-47956	CAMSHAFT ASSEMBLY TOOL

Removal

1. See Figure 3-108. Remove screws (4) and remove secondary cam chain tensioner (3).

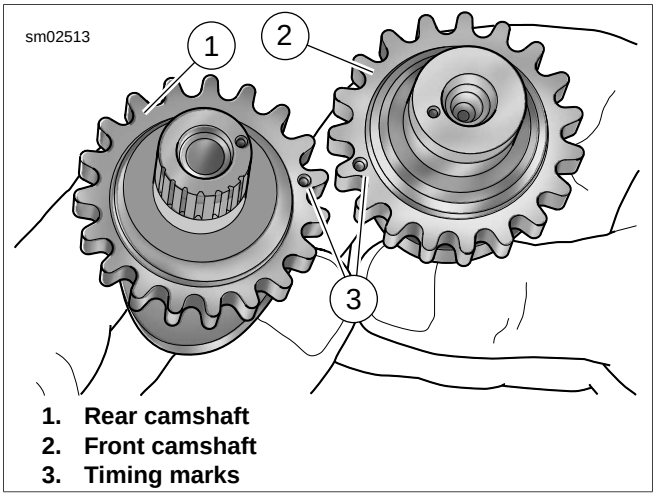
Assembly

1. See Figure 3-109. Align timing marks on teeth of secondary cam sprockets (outboard faces).

NOTE

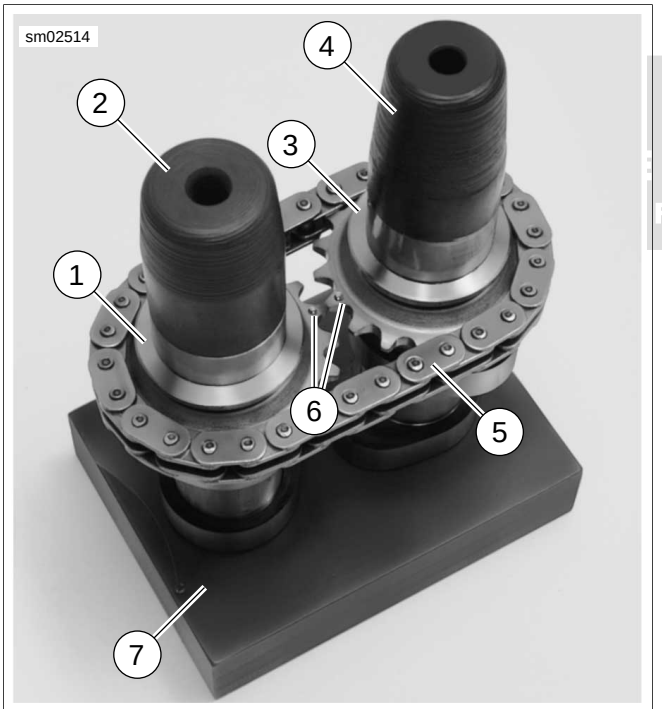
Do not mix camshafts during the installation procedure. The rear camshaft, which can be identified by the splined shaft, must go into the hole at the rear of the cam support plate.

2. Place the secondary cam chain around the sprockets of both the front and rear camshafts while keeping the timing marks (3) in alignment. To maintain the original direction of rotation, be sure that the mark placed on the chain link during disassembly is visible during installation.



1. **Rear camshaft**
2. **Front camshaft**
3. **Timing marks**

Figure 3-109. Camshaft Timing Marks



1. **Rear camshaft**
2. **Small guide**
3. **Front camshaft**
4. **Large guide**
5. **Cam chain**
6. **Timing marks**
7. **Assembly tool base**

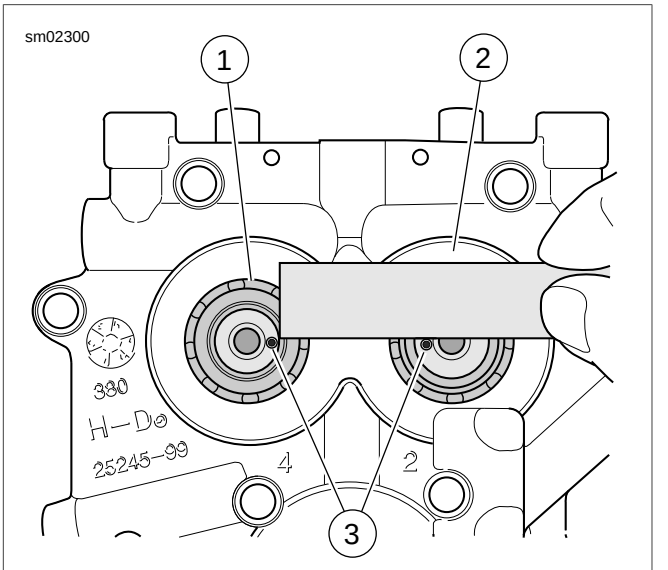
Figure 3-110. Camshaft Assembly Tool

3. See Figure 3-110. Obtain CAMSHAFT ASSEMBLY TOOL (Part No. HD-47956). Place crankcase side of camshaft/cam chain assembly into assembly tool base (7) while maintaining cam timing mark (6) alignment.
4. Place small guide (2) on rear camshaft (1). Place large guide (4) on front camshaft (3).
5. Lubricate support plate camshaft cavities with clean H-D 20W50 engine oil.
6. Install cam support plate over guides.
7. Remove guides and base.
8. See Figure 3-111. Using a straightedge, verify that the timing marks are in alignment. If they are not, then the camshafts must be removed, realigned and reinstalled.

⚠WARNING

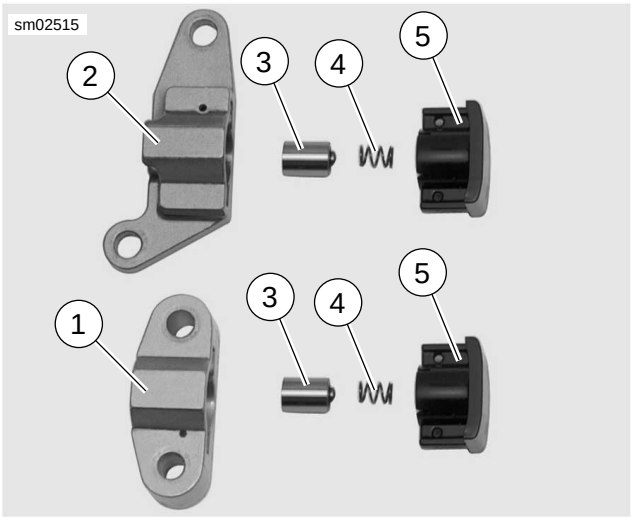
Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

9. Install 0.100 in. (2.54 mm) thick front camshaft spacer over end of front camshaft.
10. With the sharp edge out, install **new** retaining ring in groove at end of front camshaft.
11. Inspect primary and secondary cam chain tensioners.
 a. Inspect tensioners for wear. Replace tensioners if damaged or if chain contact portion of shoe material is less than 0.060 in. (1.52 mm) thick.
 b. See Figure 3-112. Be sure primary and secondary cam chain tensioners are assembled as shown. If assembled incorrectly, tensioners will not function properly.
12. Install secondary cam chain tensioner. Tighten fasteners to 100-120 **in-lbs** (11.3-13.6 Nm).



1. **Rear camshaft**
2. **Front camshaft**
3. **Timing marks**

Figure 3-111. Verify Alignment of Timing Marks



1. **Secondary cam chain tensioner**
2. **Primary cam chain tensioner**
3. **Piston**
4. **Spring**
5. **Shoe**

Figure 3-112. Cam Chain Tensioner Assemblies

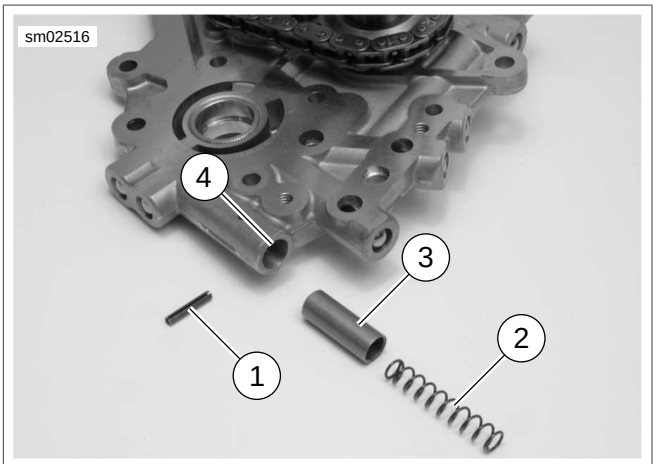
OIL PRESSURE RELIEF VALVE

Removal

1. Before removal, see 3.27 OIL PUMP, Cleaning and Inspection.
2. Secure the cam support plate in a vise with access to the roll pin. Be sure to install a pair of brass jaw inserts in the vise to avoid damage to the casting.
3. See Figure 3-113. Using a 1/8 in. punch with a small hammer, carefully tap roll pin (1) from pin hole in cam support plate. Discard roll pin.
4. Remove spring (2) and valve body (3) from bypass port.

Installation

1. Secure the cam support plate in a vise. Be sure to install a pair of brass jaw inserts to avoid damage to the casting.
2. See Figure 3-113. Lubricate valve body (3) with clean H-D 20W50 engine oil. Slide valve body into bypass port of cam support plate with the open side facing outward.
3. Slide spring (2) into bypass port until seated in open side of valve body.
4. Start **new** roll pin (1) into hole in cam support plate. Compress spring in port using the blade of a small screwdriver.
5. Holding spring compressed, tap roll pin into cam support plate until it approaches pin hole on opposite side.
6. Remove screwdriver to release spring. Verify that spring is straight and square in bore.
7. Using a 1/8 in. punch with a small hammer, carefully tap roll pin until flush with casting.



1. **Roll pin**
2. **Spring**
3. **Valve body**
4. **Bypass port**

Figure 3-113. Oil Pressure Relief Valve Assembly

Inspection

NOTE

If diagnosing low oil pressure, start with step 1. If diagnosing high oil pressure, then begin with step 2.

1. Insert straight stiff wire into unplugged hole outboard of roll pin until it bottoms. Mark wire and measure distance from edge of cam support plate to inboard side of piston. With piston fully seated in the bore, depth should be approximately 2.25 in. (57.15 mm). If it is not, continue with next step.
2. Remove oil pressure relief valve.
3. Inspect spring for stretching, kinks, or distortion.
4. Inspect piston and bore for burrs, scoring or other damage. Look for steel particles or aluminum chips. Replace cam support plate and piston if any of these conditions are found.
5. Install piston in bore and measure running clearance. If running clearance exceeds 0.003 in. (0.076 mm), install **new** piston and measure again. Replace cam support plate if running clearance still exceeds specification.

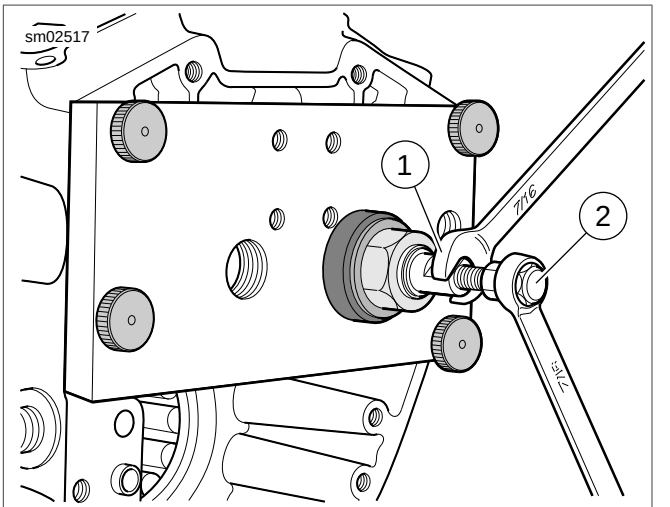
CAM NEEDLE BEARINGS

PART NUMBER	TOOL NAME
HD-42325-A	CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER

Removal

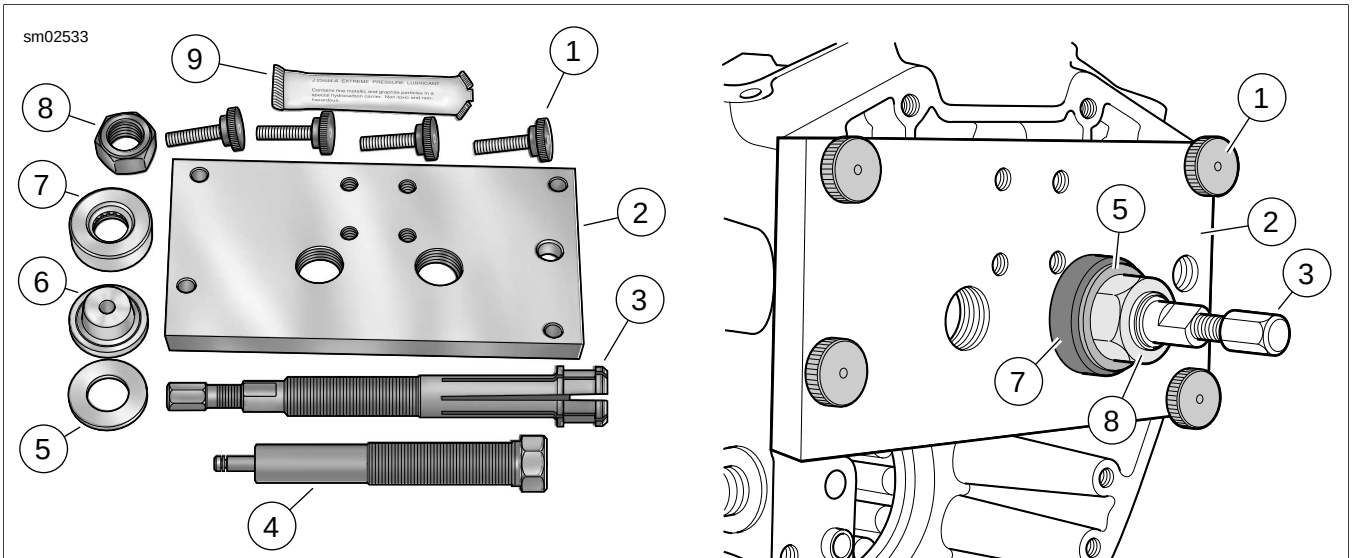
1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325-A).
2. See Figure 3-115. Remove four thumb screws (1) from threaded holes in support plate (2), if installed.
3. Sparingly apply graphite lubricant (9) to threads of collet (3) to prolong service life and verify smooth operation.

4. Slide collet through support plate so that threaded end exits stamped side of plate.
5. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.
6. Align four holes at corners of support plate with threaded holes in crankcase flange. Install thumb screws in these holes to secure support plate to crankcase.
7. Center expandable end of collet in bearing bore and slide Nice bearing (7) and flat washer (5) on threaded end. Start hex nut (8) on threaded end.
8. Push expandable end of collet through bearing bore into flywheel compartment. Feel for inside edge of needle bearing using end of collet and then back off slightly.



1. **Flat**
2. **Hex**

Figure 3-114. Expanding Collet by Turning Hex Clockwise



1. **Thumb screw**
2. **Support plate**
3. **Removal collet (Threaded end: left, Expandable end: right)**
4. **Installer forcing screw**
5. **Flat washer**
6. **Installer (1 in., 25.4 mm)**
7. **Nice bearing**
8. **Hex nut**
9. **Graphite lubricant**

Figure 3-115. Camshaft Needle Bearing Remover/Installer (Part No. HD-42325-A)

9. Holding collet to prevent lateral movement, finger tighten hex nut until Nice bearing contacts support plate.
10. See Figure 3-119. Using a 7/16 in. open end wrench, hold flat on collet to prevent rotation. Using a second 7/16 in. open end wrench, expand collet by turning hex at end of shaft in a clockwise direction. Expandable end of collet makes contact with needle bearing ID.
11. See Figure 3-114. Using a 15/16 in. open end wrench, turn hex nut in a clockwise direction until bearing is free. If necessary, hold flat on collet to prevent rotation.
12. Remove four thumb screws and pull support plate from crankcase.
13. Holding flat on collet, turn hex at end of shaft in a counter-clockwise direction to close collet. Remove and discard needle bearing.
14. Remove hex nut, flat washer and Nice bearing from threaded end of collet. Pull collet from support plate.
15. Repeat this procedure to remove second needle bearing.

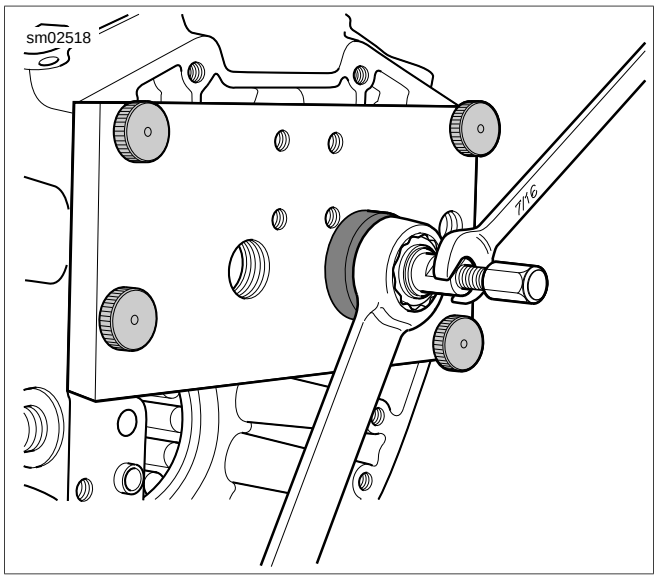


Figure 3-116. Bearing Removal

8. Align four holes at corners of support plate with threaded holes in crankcase flange. Install thumb screws in these holes to secure support plate to crankcase.

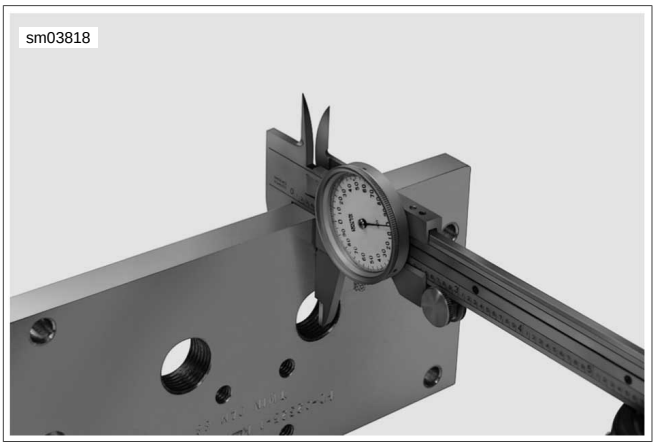


Figure 3-117. Measure Thickness of Support Plate

Installation

1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325-A).

NOTE

To avoid engine damage, care must be taken to install needle bearings to the correct depth. The correct depth is achieved only when the edge of the needle bearing is 3.10 in. (78.7 mm) from the cam cover flange.

2. Since measuring from the top of the support plate is easier and produces the most accurate and consistent results, proceed as follows:
 a. See Figure 3-117. Using a dial caliper, measure thickness of support plate.
 b. To determine the required distance from the top of the support plate to the edge of the installed needle bearing, add measurement obtained in the previous step to 3.10 in. (78.7 mm).

NOTE

For example, if the support plate is 0.50 in. (12.7 mm) thick, then the measurement from the top of the support plate to the edge of the needle bearing should be 3.60 in. (91.4 mm).

3. See Figure 3-115. Sparingly apply graphite lubricant (9) to threads of installer forcing screw (4) to prolong service life and verify smooth operation.
4. Thread installer forcing screw into stamped side of support plate (2) until threads begin to emerge from opposite side.
5. Place installer (6) at end of installer forcing screw.
6. Place **new** needle bearing on installer with lettered side facing shoulder of installer.
7. See Figure 3-118. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.

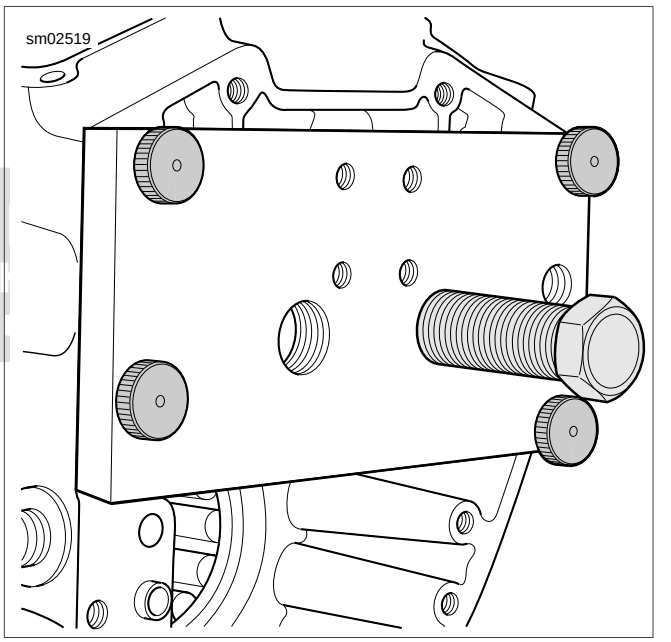


Figure 3-118. Installer Forcing Screw Installation

9. Install first needle bearing as follows:
 a. See Figure 3-119. Turn hex at end of installer forcing screw in a clockwise direction to press needle bearing into bore.
 b. Back out forcing screw. Reaching into crankcase, remove installer. Remove forcing screw from support plate.
 c. See Figure 3-120. Inserting dial caliper through forcing screw bore, measure distance from top of support plate to edge of needle bearing.
 d. If bearing is not installed to the correct depth (as calculated earlier), install forcing screw and installer and repeat the three previous steps.
 e. Install forcing screw back into support plate. Reaching into crankcase, place installer at end of forcing screw. Hand turn forcing screw until shoulder on installer makes contact with edge of needle bearing.

NOTE

In the next step, a measurement will be taken of the distance from the head of the installer forcing screw to the support plate. This measurement will be used for installing the second needle bearing. For an accurate measurement, be sure the shoulder on the installer is in contact with the edge of the needle bearing.

10. See Figure 3-121. Using a dial caliper, measure from head (top) of installer forcing screw to support plate. Record this measurement.
11. Back out forcing screw. Reaching into crankcase, remove installer. Remove forcing screw from support plate.
12. Install forcing screw in support plate over second needle bearing bore. Reaching into crankcase, place installer at end of forcing screw. Place **new** needle bearing on installer with lettered side facing shoulder of installer.
13. Turn hex on forcing screw in a clockwise direction until distance from head (top) of forcing screw to support plate equals measurement obtained previously.

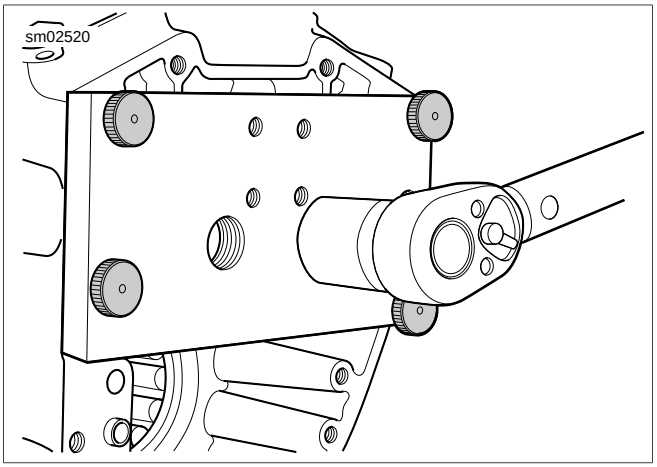


Figure 3-119. Bearing Installation

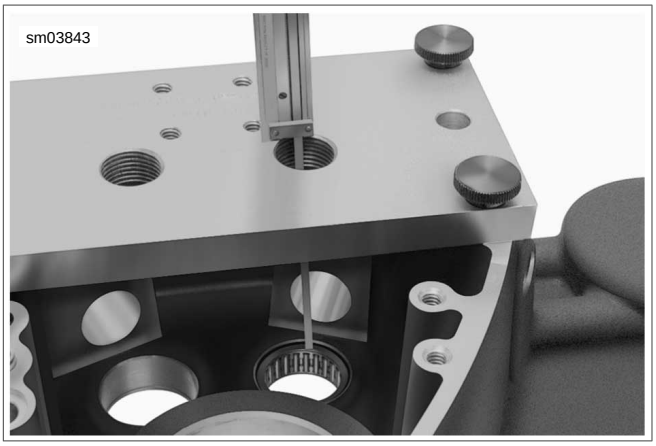


Figure 3-120. Measure from Top of Support Plate to Edge of Needle Bearing

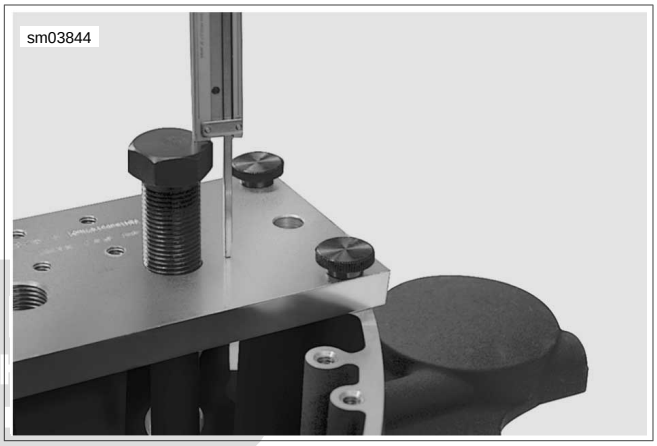


Figure 3-121. Measure from Top of Forcing Screw to Support Plate

CLEANING AND INSPECTION

Oil Pressure Valve

See 3.26 CAM SUPPORT PLATE AND COVER, Oil Pressure Relief Valve.

Cam Support Plate

Verify that all oil holes are clean and open.

NOTE

Exercise caution to avoid enlarging the oil holes or oil pressure will be adversely affected.

INSTALLATION OVERVIEW

1. Begin with 3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover.
2. Continue with 3.17 TOP END OVERHAUL: ASSEMBLY.

OIL PUMP 3.27

REMOVAL OVERVIEW

1. See 3.16 TOP END OVERHAUL: DISASSEMBLY.
 a. Remove breather assembly.
 b. Remove rocker arm support plate.
 c. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
2. Fashion lifter holding tool to prevent the hydraulic lifters from dropping into the cam compartment during cam support plate removal. See 3.26 CAM SUPPORT PLATE AND COVER.
3. To remove cover and cam support plate, see 3.18 BOTTOM END OVERHAUL: DISASSEMBLY. Remove oil pump after removing cam support plate.

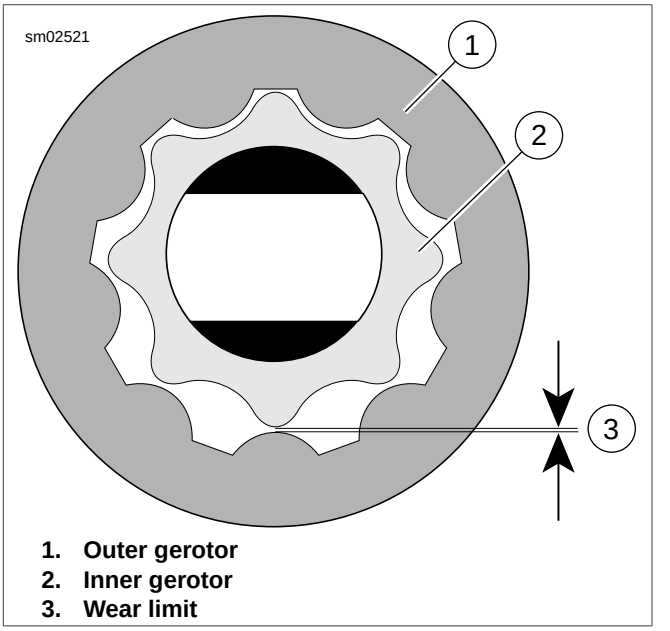
CLEANING AND INSPECTION

1. Clean all parts in a non-volatile cleaning solution or solvent.

⚠WARNING

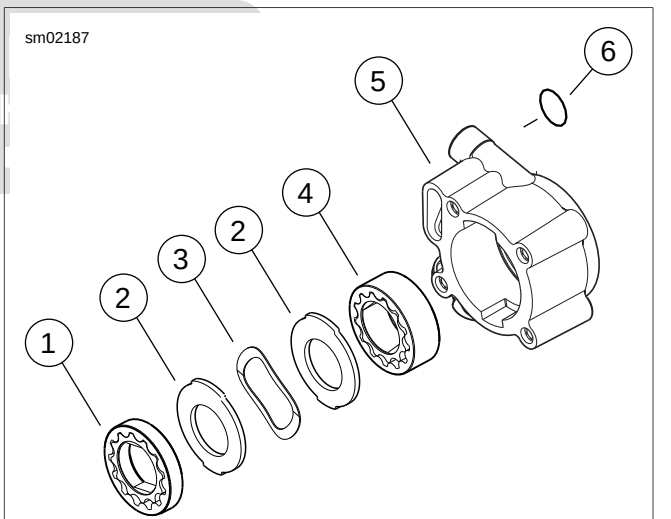
Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

2. Blow parts dry with low pressure compressed air. Verify that all oil passages are clean and open.
3. Look for scoring, gouging or cracking caused by foreign material that may have passed through the oil pump.
4. Look for grooves or scratches on the cam support plate, which serves as the outboard side of the oil pump.
5. Check for excessive wear or damage on lobes of outer gerotor gears and between lobes on inner gerotor gears.
6. See Figure 3-122. Check gerotor wear.
 a. Mesh pieces of one gerotor set together.
 b. Use a feeler gauge to determine clearance between tips of lobes on inner and outer gerotors.
 c. Replace gerotors as a set if clearance exceeds 0.004 in. (0.10 mm). Inspect second gerotor set in the same manner.
7. Measure thickness of inner gerotor of one set with a micrometer. Measure the outer gerotor of the same set. Replace the gerotor set if the difference exceeds 0.001 in. (0.025 mm). Inspect second gerotor set in the same manner.
8. See Figure 3-123. Assemble the oil pump. Verify that feed gerotors stand proud of the oil pump surface 0.015-0.025 in. (0.38-0.64 mm). If measurement is less than 0.015 in. (0.38 mm), remove feed gerotor set and reassemble using new wave washer. Repeat measurement and replace oil pump body if still not within specification.



1. **Outer gerotor**
2. **Inner gerotor**
3. **Wear limit**

Figure 3-122. Measure Gerotor Sets for Wear



1. **Narrow gerotor set (feed)**
2. **Separator plate**
3. **Wave washer**
4. **Wide gerotor set (scavenge)**
5. **Oil pump housing**
6. **Scavenge port O-ring**

Figure 3-123. Assembling Oil Pump

INSTALLATION OVERVIEW

1. See 3.26 CAM SUPPORT PLATE AND COVER, Installation Overview.
2. Continue with 3.17 TOP END OVERHAUL: ASSEMBLY.

CRANKCASE 3.28

REMOVAL OVERVIEW

1. Perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.
2. Perform all steps under 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.

RIGHT CRANKCASE HALF

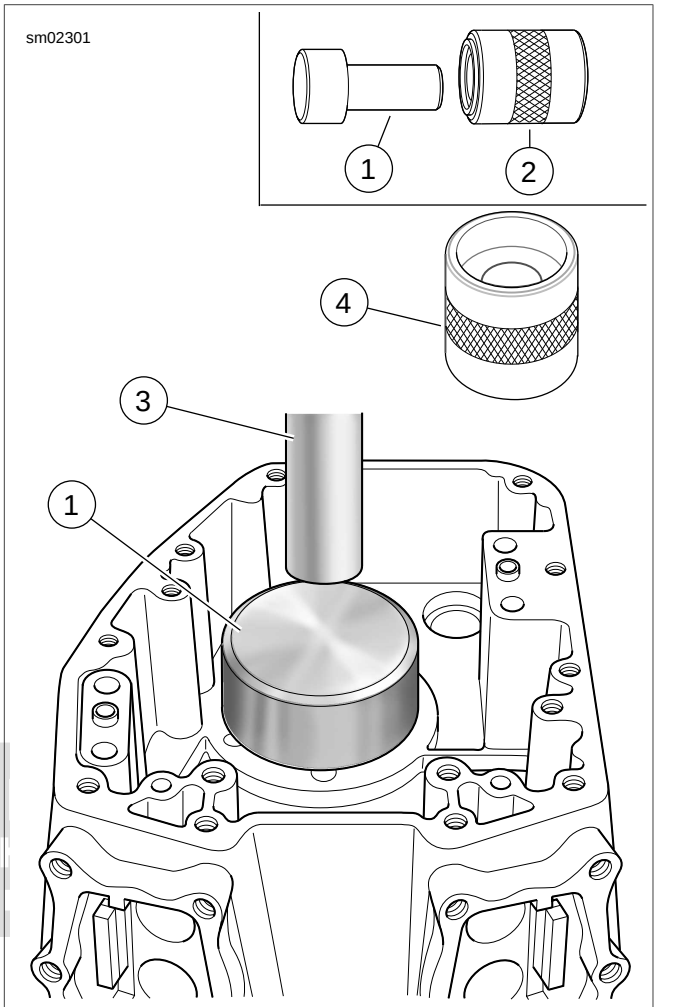
PART NUMBER	TOOL NAME
B-45655	CRANKCASE BEARING REMOVER/INSTALLER
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE

Main Bearing Removal

NOTE

Do not move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and could be dropped.

1. See Figure 3-124. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).
2. Place support tube (2) on hydraulic press table with the "A" end up. Note that the sides of the support tube are stamped to verify proper orientation.
3. With the outboard side of the right crankcase half facing upward, position main bearing bore over support tube. During removal it is important that the curved edges on the pilot/driver (1) match the curved edges of the crankcase.
4. Slide pilot/driver (1) through bearing into support tube.
5. Center pilot/driver under ram (3) of press. Apply pressure to pilot/driver until bearing is free.
6. Remove crankcase, pilot/driver and bearing from support tube. Discard bearing.



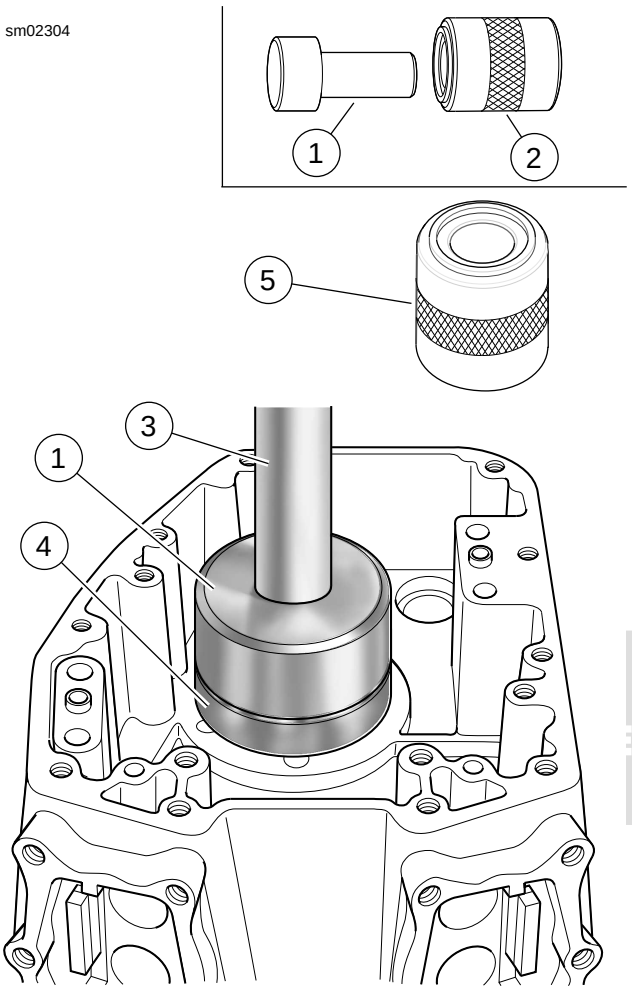
1. **Pilot/driver**
2. **Support tube**
3. **Ram**
4. **Support tube (2) "A" end up**

Figure 3-124. Right Main Bearing Removal

Main Bearing Installation

1. See Figure 3-125. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).
2. Obtain **new** main bearing (4). Spread a thin film of clean engine oil on O.D. of **new** bearing.
3. Turn support tube (2) over so that the "B" end is up. The sides of the support tube are stamped "A" and "B" to verify proper orientation.
4. With the outboard side of the right crankcase half facing upward, position main bearing bore over support tube.
5. Lubricate leading edge (letter side) of **new** main bearing with clean engine oil. Start leading edge of bearing in bearing bore.

6. Slide pilot/driver (1) through bearing into support tube.
7. Center pilot/driver under ram (3) of press. Apply pressure to pilot/driver until resistance is felt and bearing is bottomed on the support tube.
8. Remove pilot/driver and crankcase half from support tube.

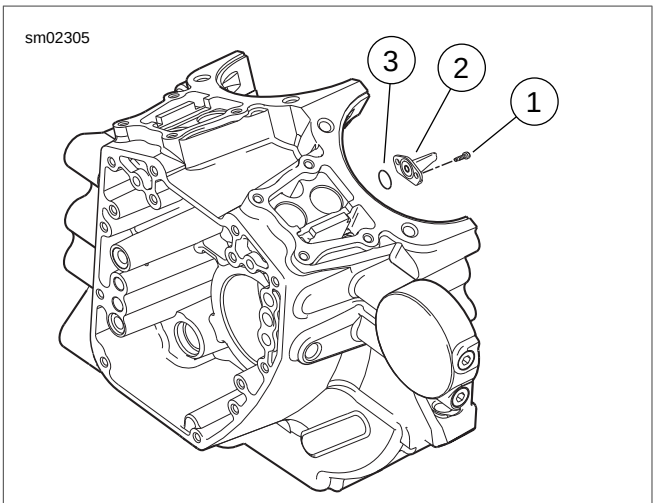


1. **Pilot/driver**
2. **Support tube**
3. **Ram**
4. **Main bearing**
5. **Support tube (2) "B" end up**

Figure 3-125. Right Main Bearing Installation

Piston Jets Removal

1. See Figure 3-126. Remove two T20 TORX screws (1) to free piston jet (2) from crankcase.
2. Remove o-ring (3) from groove in mounting flange of jet. Discard o-ring.



1. **T20 TORX screw**
2. **Piston jet**
3. **O-ring**

Figure 3-126. Piston Jets

Piston Jets Installation

NOTES

- *If piston jet is being reused, apply LOCTITE THREADLOCKER 222 (purple) to threads of TORX screws before installation.*
- *O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings keeping them packaged until use to avoid confusion.*

1. See Figure 3-126. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring (3) for piston jet. Install **new** o-ring in groove of jet mounting flange.
2. With jet pointed upward, start two T20 TORX screws (1) to secure piston jet (2) to crankcase. Tighten to 25-35 **in-lbs** (2.8-3.9 Nm).

LEFT CRANKCASE HALF

PART NUMBER	TOOL NAME
B-45655	CRANKCASE BEARING REMOVER/INSTALLER
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE

Main Bearing Removal

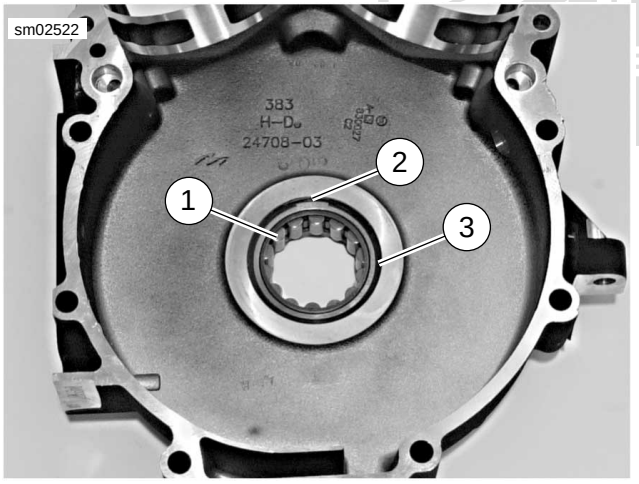
NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and could be dropped.

⚠CAUTION

Do not rotate left crankcase half in engine stand such that flywheel sprocket shaft is facing up. The flywheel assembly can fall out, resulting in parts damage or moderate injury. (00552b)

1. While holding flywheel assembly so that it does not fall out of left crankcase half, rotate bottom end assembly in engine stand so assembly is upright and flywheel shafts are horizontal.
2. Carefully slide flywheel assembly out of left crankcase and place it in a clean safe place.
3. Unbolt left crankcase half from stand and move it to bench area. Remove thrust washer from outboard side of crankcase half by pulling it past oil seal. Set thrust washer aside for inspection or reuse.
4. Remove oil seal from crankcase bore. Discard oil seal.
5. See Figure 3-127. The left main bearing (1) is press-fit into the main bearing bore (2) in the left crankcase and secured with a retaining ring (3) on the inboard side. See Figure 3-128. Using the tip of a flat blade screwdriver, carefully lift the edge of the retaining ring up out of its groove in the crankcase. Slide the screwdriver tip around the edge of the bearing, lifting the retaining ring up and out of the groove. Be careful not to damage the lip of the groove in the crankcase.



1. **Main bearing**
2. **Main bearing bore**
3. **Retaining ring**

Figure 3-127. Left Main Bearing Assembly

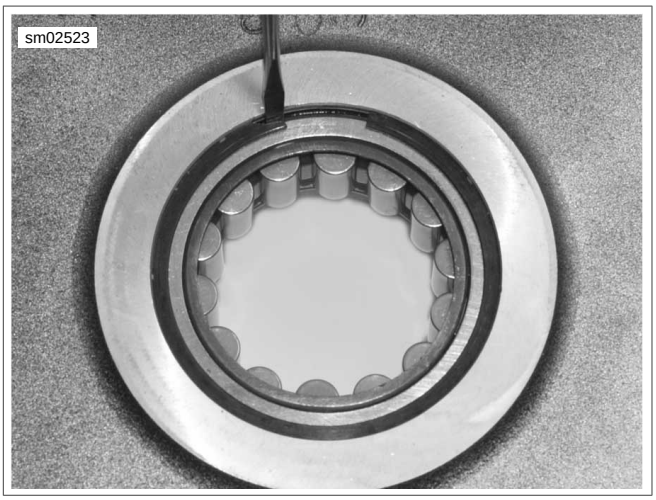
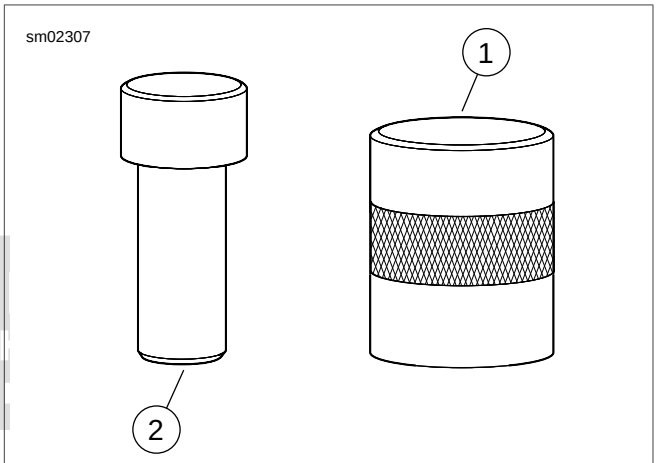
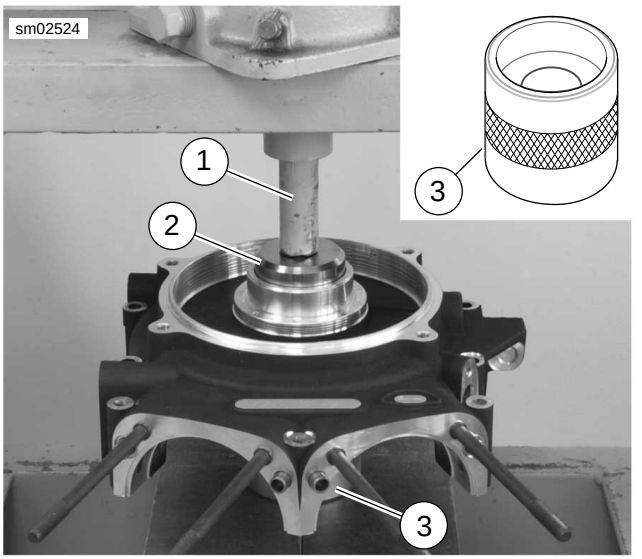


Figure 3-128. Removing Retaining Ring



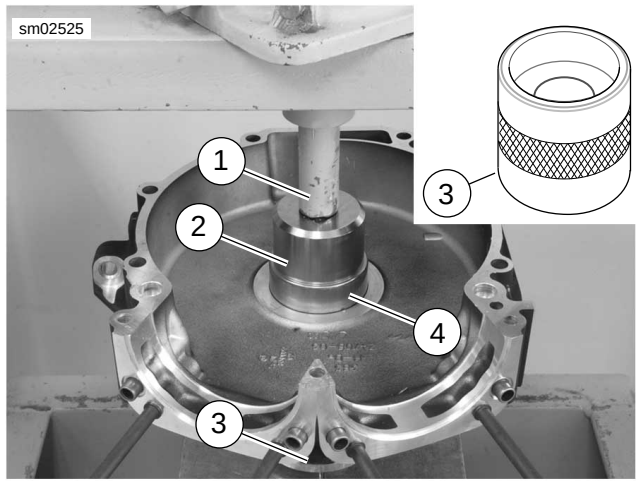
1. **Support tube**
2. **Pilot/driver**

Figure 3-129. Left Main Bearing Remover and Installer Tools



1. **Ram**
2. **Pilot/driver**
3. **Support tube ("B" end up)**

Figure 3-130. Left Main Bearing Removal



1. **Ram**
2. **Pilot/driver**
3. **Support tube ("A" end up)**
4. **Main bearing**

Figure 3-131. Left Main Bearing Installation

NOTE

See Figure 3-129. If the ram of the press is wider than the head of pilot/driver (2), a suitable press plug will be needed in order to remove the main bearing.

6. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).
7. See Figure 3-130. Place support tube (3) on hydraulic press table with "B" end up. Note that sides of support tube are stamped "A" and "B" to verify proper orientation.
8. With the outboard side of the left crankcase half facing upward, position main bearing bore over support tube.
9. Slide pilot/driver (2) through main bearing into support tube (3).
10. If the ram of the press is wider than the head of pilot/driver (2), place a suitable press plug on top of pilot/driver (2).
11. Center pilot/driver under ram (1) of press. Apply pressure to pilot/driver until bearing is free.
12. Remove crankcase half, pilot/driver and bearing from support tube. Discard bearing.

Main Bearing Installation

NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and could be dropped.

1. See Figure 3-129. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).
2. See Figure 3-131. Obtain **new** main bearing (4). Place a thin film of clean engine oil on outer diameter of bearing.
3. Place support tube (3) on hydraulic press table with the "A" end up.
4. With the inboard side of the left crankcase half facing upward, position main bearing bore over support tube.
5. Lubricate leading edge of **new** main bearing before placement. Start **new** main bearing in bearing bore, letter side down.
6. Slide pilot/driver (2) through bearing into support tube.
7. Center pilot/driver (2) under ram (1) of press. Apply pressure to pilot/driver until bearing is lightly bottomed in main bearing bore.
8. Remove crankcase half and pilot/driver from support tube.
9. Obtain **new** retaining ring and install in bearing bore in inboard side of crankcase half. Work retaining ring into groove, being careful not to damage edges of groove. Make sure retaining ring is fully seated in groove.

NOTE

If retaining ring will not fit into groove in bearing bore, it is a sign that the bearing is not fully seated in the bore. Examine the bearing and bore. If necessary, remove bearing, clean bore and install bearing. Then install retaining ring.

SPROCKET SHAFT BEARING INNER RACE

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-34902-B	MAINSHAFT BEARING INNER RACE PULLER/INSTALLER
HD-44358	FLYWHEEL SUPPORT FIXTURE
HD-95637-46B	WEDGE ATTACHMENT
HD-97225-55C	SPROCKET SHAFT BEARING INSTALLER

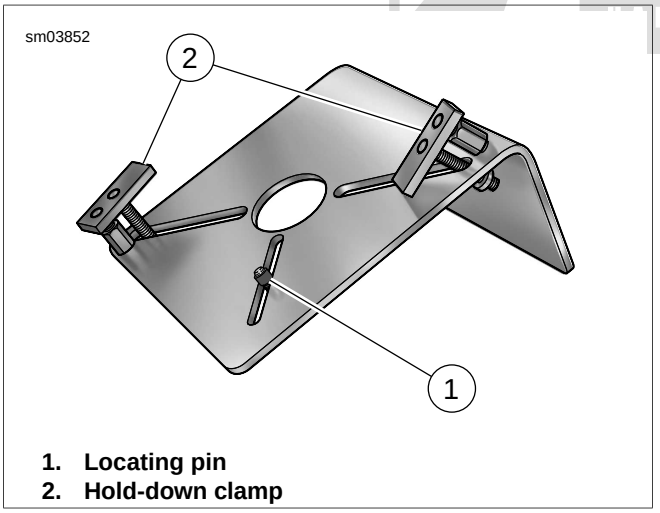
Removal

If reusing flywheel, remove bearing inner race and thrust washer as follows:

1. Obtain FLYWHEEL SUPPORT FIXTURE (Part No. HD-44358). See Figure 3-132. Install brass jaws or shop towels around teeth of vise to prevent damage to tool. Clamp tool in vise with the round hole topside.
2. Insert crankshaft end through hole resting flywheel assembly on fixture. Slide knurled locating pin down slot in tool to engage crank pin hole. Hand tighten locating pin.
3. Slide hold-down clamp down slot to engage inboard side of right flywheel half, and then hand tighten knurled nut at bottom to secure. Repeat step to secure hold-down clamp on opposite side of flywheel.

NOTE

For proper clamping force, hold-down clamp must not be tilted. Rotate hex on outboard stud until clamp is level.



1. **Locating pin**
2. **Hold-down clamp**

Figure 3-132. Flywheel Fixture (Part No. HD-44358)

4. Position WEDGE ATTACHMENT (Part No. HD-95637-46B) on inboard side of thrust washer and turn hex nuts an equal number of turns to draw halves of wedge together.

CAUTION

Install wedge attachment only so far as necessary to ensure positive contact with bearing inner race. Installing tool with more contact than necessary will result in damage to the flywheel (00500b)

5. Obtain two 3/8-16 inch bolts 7-1/2 inches long (with flat washers). Install flat washers on bolts. Obtain bridge and forcing screw from MAINSHAFT BEARING INNER RACE PULLER/INSTALLER (Part No. HD-34902-B). Also obtain a suitable hardened washer to use between the puller screw and the end of the shaft.
6. Slide one bolt into channel on each side of bridge so that flat washer is between bridge and bolt head. Thread bolts into wedge attachment an equal number of turns.
7. Sparingly apply graphite lubricant to threads of forcing screw to prolong service life and verify smooth operation. Start forcing screw into center hole of bridge.

NOTE

Failure to use hardened washer may result in damage to forcing screw and/or sprocket shaft.

8. Place hardened washer against end of sprocket shaft. Thread forcing screw into bridge until the steel ball at the end of the screw makes firm contact with hardened washer.
9. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

NOTE

To facilitate removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

WARNING

Do not use heating devices with penetrating oil. Penetrating oil is flammable which could result in death or serious injury. (00375a)

10. Turn forcing screw until thrust washer and bearing inner race move approximately 1/8 in. (3.2 mm).
11. Turn hex nuts an equal number of turns to separate halves of WEDGE ATTACHMENT (Part No. HD-95637-46B).
12. After bottoming thrust washer on shaft, reposition WEDGE ATTACHMENT (Part No. HD-95637-46B) on inboard side of bearing inner race. Turn hex nuts an equal number of turns to draw halves of wedge together.

CAUTION

Install wedge attachment only so far as necessary to ensure positive contact with bearing inner race. Installing tool with more contact than necessary will result in damage to the flywheel (00500b)

13. See Figure 3-133. Verify that the tool assembly is square, so that the bearing inner race is not cocked during removal.

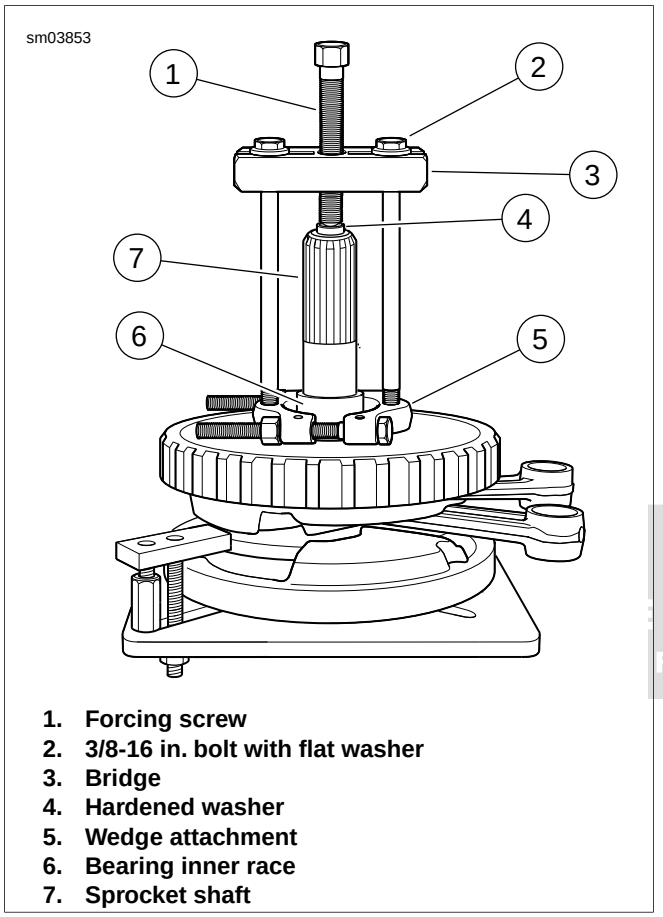
14. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

NOTE

To facilitate removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

15. Turn forcing screw until bearing inner race is pulled free of sprocket shaft.

16. Remove thrust washer from sprocket shaft.



1. **Forcing screw**
2. **3/8-16 in. bolt with flat washer**
3. **Bridge**
4. **Hardened washer**
5. **Wedge attachment**
6. **Bearing inner race**
7. **Sprocket shaft**

Figure 3-133. Remove Inner Race from Sprocket Shaft

Installation

1. Place **new** thrust washer over sprocket shaft.

2. Place **new** bearing inner race on bench top. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat bearing inner race for about 60 seconds using a circular motion.

3. Wearing suitable gloves to protect hands from burns, place heated bearing inner race over sprocket shaft.

NOTE

To facilitate installation without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

⚠WARNING

Do not use heating devices with penetrating oil. Penetrating oil is flammable which could result in death or serious injury. (00375a)

4. See Figure 3-134. Obtain the SPROCKET SHAFT BEARING INSTALLER (Part No. HD-97225-55C). Assemble tool as described below.
 a. See Figure 3-135. Thread pilot adapter into sprocket shaft.
 b. Thread pilot shaft onto pilot adapter.
 c. Slide long collar over pilot shaft until it contacts bearing inner race.
 d. Slide short collar over pilot shaft until it contacts long collar.
 e. Slide Nice bearing and large flat washer over pilot shaft.
 f. Sparingly apply graphite lubricant to threads of pilot shaft to prolong service life and verify smooth operation.
 g. See Figure 3-136.Thread handle onto pilot shaft.

5. See Figure 3-137. Rotate handle of tool in a clockwise direction until bearing inner race makes firm contact with thrust washer. Verify that thrust washer cannot be rotated by hand.

6. Remove handle, flat washer, Nice bearing, short collar, long collar, pilot shaft and pilot adapter from sprocket shaft.

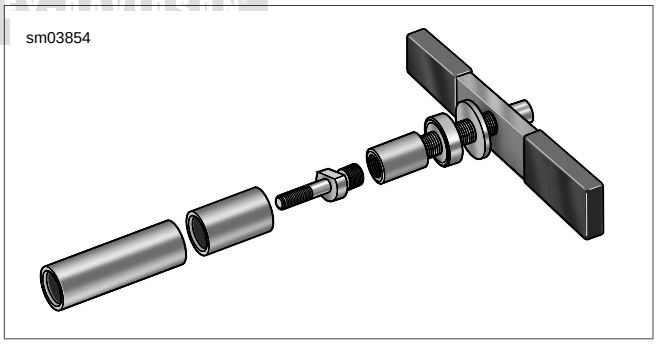


Figure 3-134. Sprocket Shaft Bearing Installer (Part No. HD-97225-55C)

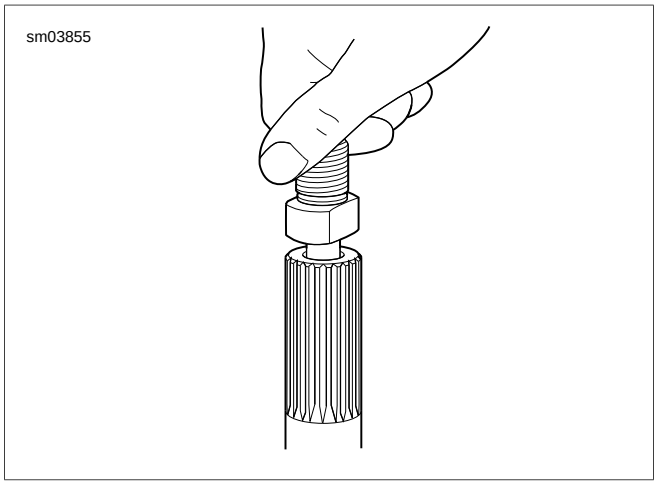
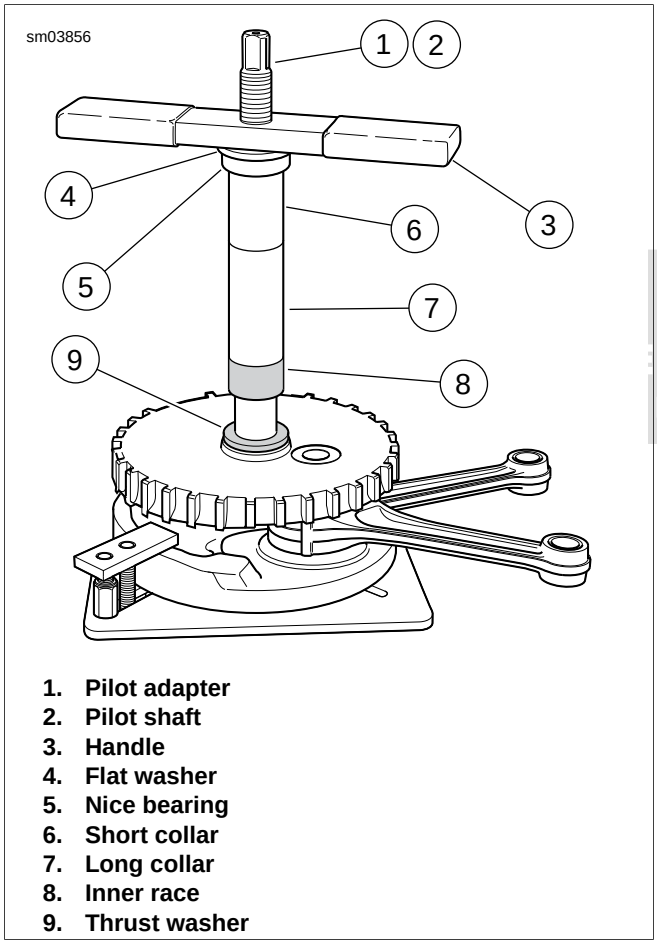


Figure 3-135. Thread Pilot Adapter into Sprocket Shaft



1. **Pilot adapter**
2. **Pilot shaft**
3. **Handle**
4. **Flat washer**
5. **Nice bearing**
6. **Short collar**
7. **Long collar**
8. **Inner race**
9. **Thrust washer**

Figure 3-136. Press Inner Race onto Sprocket Shaft: Setup

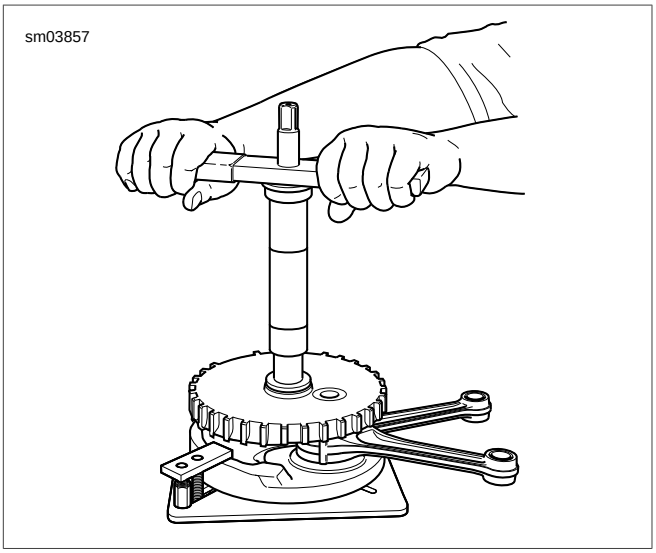


Figure 3-137. Press Inner Race onto Sprocket Shaft: Operation

CYLINDER STUDS

Removal

1. Thread a 3/8"-16 nut onto cylinder stud.
2. Thread a second nut onto stud until it contacts the first.
3. Placing wrench on first nut installed, remove stud.

Installation

1. Place a steel ball inside a head screw. Put the head screw on the end of the cylinder stud without the collar.
2. Start the stud in the cylinder deck with the collar side down. Tighten using air gun until collar reaches crankcase.
3. Hand tighten stud to 10-20 ft-lbs (3.6-27.1 Nm).

PIPE PLUG AND OIL FITTINGS

Removal

See Figure 3-138. Turn pipe plug counterclockwise until free.

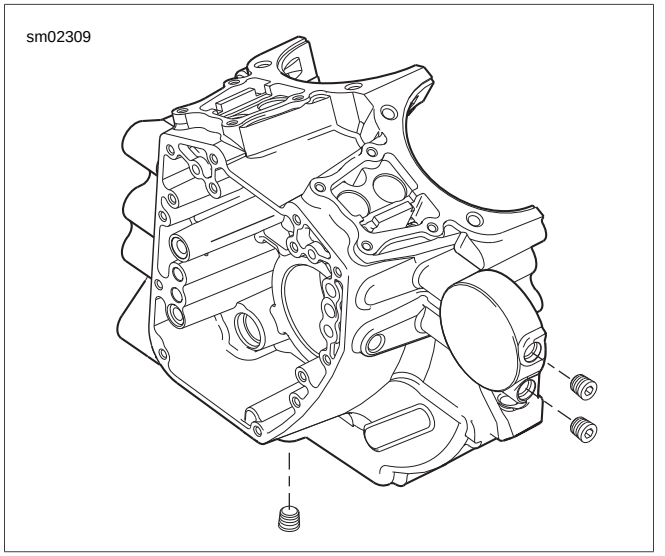


Figure 3-138. Pipe Plug

Installation

1. Apply LOCTITE PIPE SEALANT 565 to threads.
2. Install pipe plug. Tighten pipe plug to 120-144 **in-lbs** (13.6-16.3 Nm).

CLEANING AND INSPECTION

1. Scrape old gasket material from the crankcase flanges. Old gasket material left on mating surfaces will cause leaks.
2. Clean all parts in a non-volatile cleaning solution or solvent.

WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

3. Blow parts dry with low pressure compressed air.
4. Verify that all oil holes and passageways are clean and open.
5. Check ring dowels for looseness, wear or damage. Replace as necessary.
6. Use a file to carefully remove any nicks or burrs from machined surfaces.
7. Clean out tapped holes and clean up damaged threads.
8. Check the top of the crankcase for flatness with a straightedge and feeler gauge. Replace if warped.
9. Spray all machined surfaces with clean engine oil.

INSTALLATION OVERVIEW

1. Perform all steps under 3.19 BOTTOM END OVERHAUL: ASSEMBLY.
2. Perform all steps under 3.17 TOP END OVERHAUL: ASSEMBLY.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FLYWHEEL AND CONNECTING RODS 3.29

REMOVAL OVERVIEW

1. Perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.
2. Perform all steps under 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.

INSPECTION

NOTE

Do not attempt to straighten connecting rods. Straightening rods will damage both the upper bushing and lower bearing.

1. Replace the flywheel/connecting rod assembly if any of the following conditions are noted:
 a. Connecting rods are bent or twisted.
 b. Connecting rods do not fall under their own weight or are in a bind.
 c. Sprocket teeth are worn in an irregular pattern or chipped.
 d. The crankshaft (roller) bearing inner races are brinelled, burnt, scored, blued or damaged.

NOTE

Bluing on connecting rods is part of the hardening process and is considered a normal condition.

2. Check connecting rod bearing clearance. Orient the assembly as shown in Figure 3-139.
 a. Holding the shank of each rod just above the bearing bore, pull up and down on the connecting rods.
 b. Any discernible up and down movement indicates excessive lower bearing clearance. Replace the flywheel/connecting rod assembly.
3. See Figure 3-140. Check connecting rod side play.
 a. Insert a feeler gauge between the thrust washer and the outboard side of the connecting rod.
 b. Replace the assembly if rod side play exceeds 0.020 in. (0.51 mm).

NOTE

If the flywheel, connecting rods or right side bearing inner race need to be replaced, then replace the entire flywheel assembly.

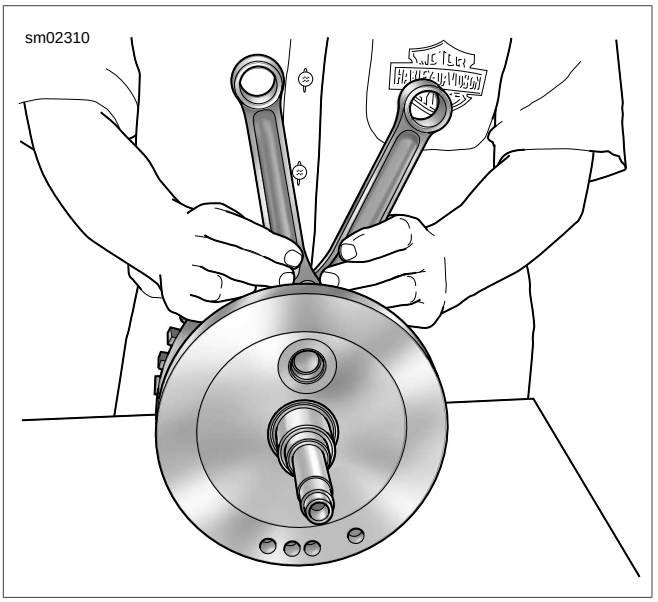


Figure 3-139. Connecting Rod Bearing Clearance

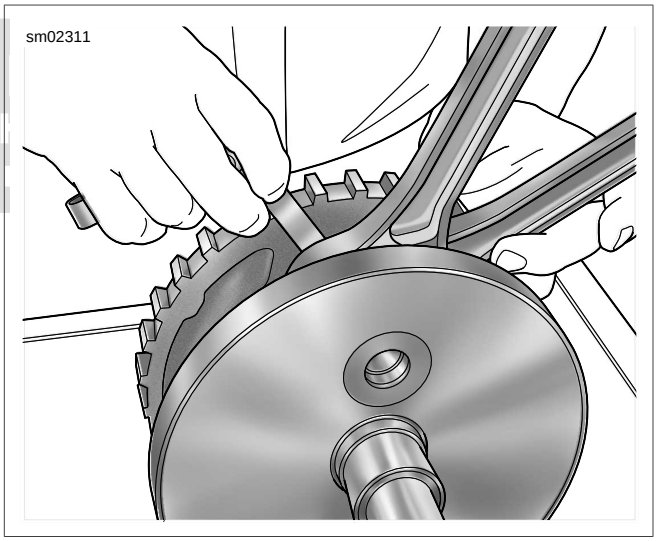


Figure 3-140. Connecting Rod Side Play

INSTALLATION OVERVIEW

1. Perform all steps under 3.19 BOTTOM END OVERHAUL: ASSEMBLY.
2. Perform all steps under 3.17 TOP END OVERHAUL: ASSEMBLY.

OIL PAN 3.30

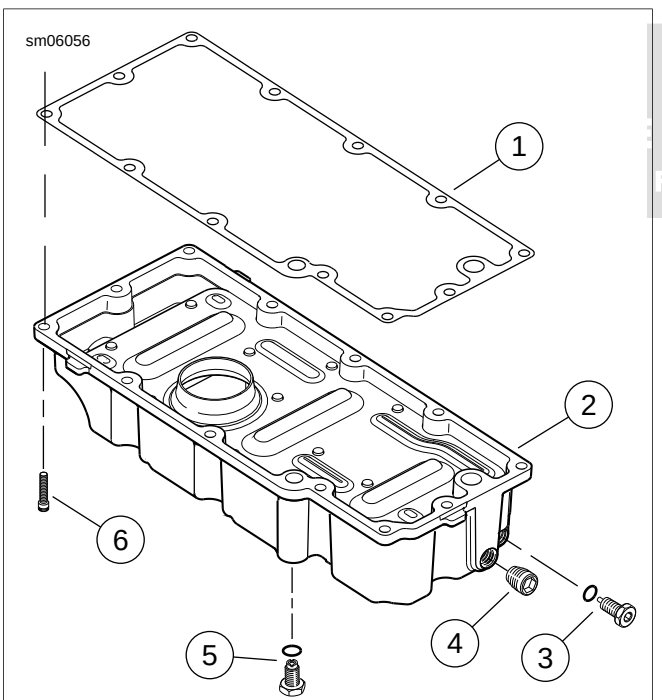
REMOVAL

1. Position motorcycle on a suitable lift.
2. See Figure 3-141. Remove engine oil drain plug (3), fill plug/dipstick and oil filter. Drain oil into suitable container.
3. Remove transmission drain plug (5) and drain transmission fluid into suitable container.
4. Remove rear wheel. See 2.5 REAR WHEEL.
5. Remove left muffler, exhaust crossover pipe and crossover pipe clamp bracket from transmission. See 4.19 EXHAUST SYSTEM.
6. See Figure 3-141. Remove 12 fasteners (6) that secure the oil pan to the transmission.

NOTE

Verify engine oil fill plug/dipstick is removed before attempting to slide the oil pan rearward or damage to the dipstick will result.

7. Slide oil pan (2) rearward to remove. Remove and discard oil pan gasket (1).
8. If necessary, remove tapered plug (4).



1. **Gasket**
2. **Pan/baffle assembly**
3. **Engine oil drain plug and O-ring**
4. **Tapered pipe plug**
5. **Transmission drain plug and O-ring**
6. **Fastener (12)**

Figure 3-141. Oil Pan Assembly

INSTALLATION

1. See Figure 3-141. Clean and examine transmission and oil pan flanges.
2. If removed, install tapered plug (4) using Loctite Pipe Sealant With Teflon 565 (P/N 99818-97). Tighten to 18-22 ft-lbs (24.4-29.8 Nm).
3. Apply a thin coat of HYLOMAR® gasket sealer to oil pan flange.
4. Place **new** gasket (1) on oil pan flange. Allow sealer to dry until tacky.
5. Position oil pan with gasket on bottom of transmission and install 12 fasteners (6), but only tighten about two turns after initial engagement.
6. Inspect the oil pan gasket to verify that it is properly positioned.
7. Tighten the oil pan fasteners (6) to 84-132 **in-lbs** (9.5-14.9 Nm) following sequence shown in Figure 3-142.
8. Wipe any foreign material from engine and transmission drain plugs. Examine drain plug O-rings for tears or damage. Replace O-rings as required.
9. Install transmission drain plug and O-ring (5). Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
10. Install engine oil drain plug and O-ring (3). Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
11. Install exhaust crossover pipe hanger bracket and tighten fasteners to 84-132 **in-lbs** (9.5-14.9 Nm).
12. Install exhaust crossover pipe and left muffler. See 4.19 EXHAUST SYSTEM.
13. Install rear wheel. See 2.5 REAR WHEEL.
14. Add fluids.
 a. Add transmission fluid and check level. See 1.8 TRANSMISSION LUBRICANT.
 b. Install engine oil filter. Add engine oil and check level. See 1.6 ENGINE OIL AND FILTER.

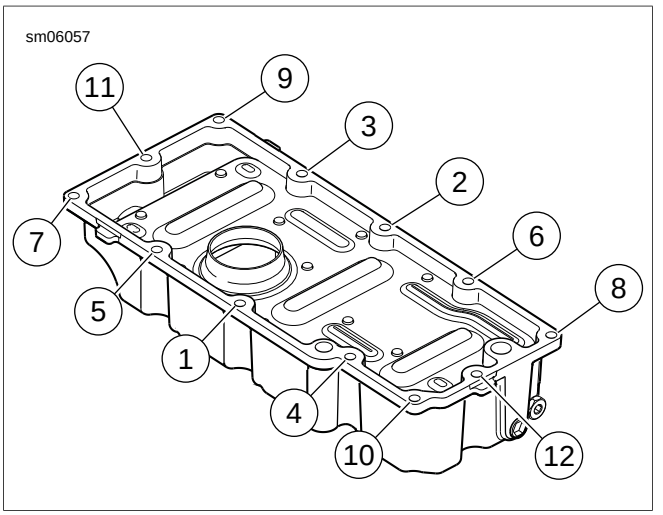


Figure 3-142. Oil Pan Torque Sequence

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

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HARLEY-DAVIDSON®

NOTES

FASTENER TORQUE VALUES 4.1

FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

FASTENER	TORQUE VALUE		NOTES
Breather bolts	22-24 ft-lbs	29.8-32.5 Nm	4.4 AIR CLEANER ASSEMBLY, Installation/metric
Charcoal canister screws	10-15 **in-lbs**	1.1-1.7 Nm	4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister/metric
Console rear bracket screws	20-30 **in-lbs**	2.7-3.4 Nm	4.5 FUEL TANK, Installation
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	4.5 FUEL TANK, Installation
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	4.5 FUEL TANK, Evaporative Emissions Tube: Non-CA Models/metric
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	4.6 FUEL TANK TOP PLATE, Installation/metric
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Fuel Vapor Vent Tube/metric
Cover bracket screws	40-60 **in-lbs**	4.5-6.8 Nm	4.4 AIR CLEANER ASSEMBLY, Installation/metric
Cover screw	36-60 **in-lbs**	4.1-6.8 Nm	4.4 AIR CLEANER ASSEMBLY, Installation/Use Loctite Medium Strength Threadlocker 243 (Blue)
Crossover pipe hanger bracket	84-132 **in-lbs**	9.5-14.9 Nm	4.19 EXHAUST SYSTEM, System Installation
Crossover support clamp-to-transmission bracket fastener	14-18 ft-lbs	19.0-24.4 Nm	4.19 EXHAUST SYSTEM, System Installation
Cylinder head flange adapter screws	96-144 **in-lbs**	10.9-16.3 Nm	4.13 INDUCTION MODULE, Installation/metric
Cylinder head flange adapter screws	96-144 **in-lbs**	10.9-16.3 Nm	4.13 INDUCTION MODULE, Installation/metric
Electrical caddy (left) screws	72-96 **in-lbs**	8.1-10.9 Nm	4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister/metric
ET sensor	120-180 **in-lbs**	13.6-20.3 Nm	4.12 ENGINE TEMPERATURE SENSOR (ET), Installation
Exhaust crossover pipe clamp	25-30 ft-lbs	33.9-40.7 Nm	4.19 EXHAUST SYSTEM, System Installation/Always use a new clamp
Exhaust flange adapter nuts	100-120 **in-lbs**	11.3-13.6 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust flange adapter nuts	100-120 **in-lbs**	11.3-13.6 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust flange adapter nuts	100-120 **in-lbs**	11.3-13.6 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust flange adapter nuts	100-120 **in-lbs**	11.3-13.6 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust heat shield worm drive clamp screw	20-40 **in-lbs**	2.3-4.5 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust side bracket carriage bolt	20-25 ft-lbs	27.1-33.9 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust valve actuator fasteners	32-40 **in-lbs**	3.6-4.5 Nm	4.20 ACTIVE EXHAUST (HDI), Exhaust Valve Actuator
Front cylinder head exhaust flange nut	9-18 **in-lbs**	1-2 Nm	4.19 EXHAUST SYSTEM, System Installation
Fuel supply line quick-connect fitting	22-26 ft-lbs	29.8-35.3 Nm	4.5 FUEL TANK, Fuel Supply Check Valve/Tube/metric
Fuel supply tube clamp screw	66-82 **in-lbs**	7.5-9.3 Nm	4.16 FUEL INJECTORS, Installation/metric
Fuel tank front screws	15-20 ft-lbs	20.3-27.1 Nm	4.5 FUEL TANK, Installation
Fuel tank rear bracket screws	15-20 ft-lbs	20.3-27.1 Nm	4.5 FUEL TANK, Installation
Handlebar clamp screws	72-80 **in-lbs**	8-9 Nm	4.10 TWIST GRIP SENSOR, Installation/metric
Handlebar switch housing screws	35-45 **in-lbs**	4-5 Nm	4.10 TWIST GRIP SENSOR, Installation/metric

FASTENER	TORQUE VALUE		NOTES
Horn bracket to cylinder head screws	35-40 ft-lbs	48-54 Nm	4.13 INDUCTION MODULE, Installation/metric
Muffler clamp	38-43 ft-lbs	51.5-58.3 Nm	4.19 EXHAUST SYSTEM, Mufflers
O2 sensor	30-44 ft-lbs	40.7-59.7 Nm	4.15 OXYGEN SENSORS (O2), Installation/metric
Rear cylinder head exhaust flange nut	9-18 **in-lbs**	1-2 Nm	4.19 EXHAUST SYSTEM, System Installation
Rear muffler fastener	96-144 **in-lbs**	10.8-16.3 Nm	4.19 EXHAUST SYSTEM, Mufflers
TMAP hex screw	84-108 **in-lbs**	9.5-12.2 Nm	4.14 TEMPERATURE MANIFOLD ABSOLUTE PRESSURE SENSOR (TMAP), Installation/metric
Top caddy hold-down	32-40 **in-lbs**	3.6-4.5 Nm	4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

SPECIFICATIONS: FUEL SYSTEM 4.2

SPECIFICATIONS

Table 4-1. Fuel Capacity: 2009 Touring Models

FUEL TANK CAPACITY	GALLONS	LITERS
Total	6.0	22.7
Reserve (warning light on)	1.0	3.79

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

ELECTRONIC FUEL INJECTION (EFI) 4.3

TROUBLESHOOTING

See the electrical diagnostic manual for troubleshooting and diagnostic information.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

AIR CLEANER ASSEMBLY 4.4

REMOVAL

1. See Figure 4-1. Remove screw from air cleaner cover. Remove air cleaner cover with rubber seal.
2. Remove three T27 TORX screws to release cover bracket from filter element.
3. Remove filter element pulling two breather tubes from holes on inboard side.
4. Remove gasket from sleeve on inboard side of filter element. Discard gasket.
5. Remove breather tubes from fittings on two cylinder head breather bolts.
6. Remove two cylinder head breather bolts from backplate.
7. Remove backplate from cylinder heads.
8. Remove seal ring from groove on inboard side of backplate. Discard seal ring.

⚠WARNING

Do not use gasoline or solvents to clean filter element. Flammable cleaning agents can cause an intake system fire, which could result in death or serious injury. (00101a)

9. Inspect filter element. See 1.9 AIR CLEANER AND EXHAUST SYSTEM. Replace the filter element if damaged or if filter media cannot be adequately cleaned.

INSTALLATION

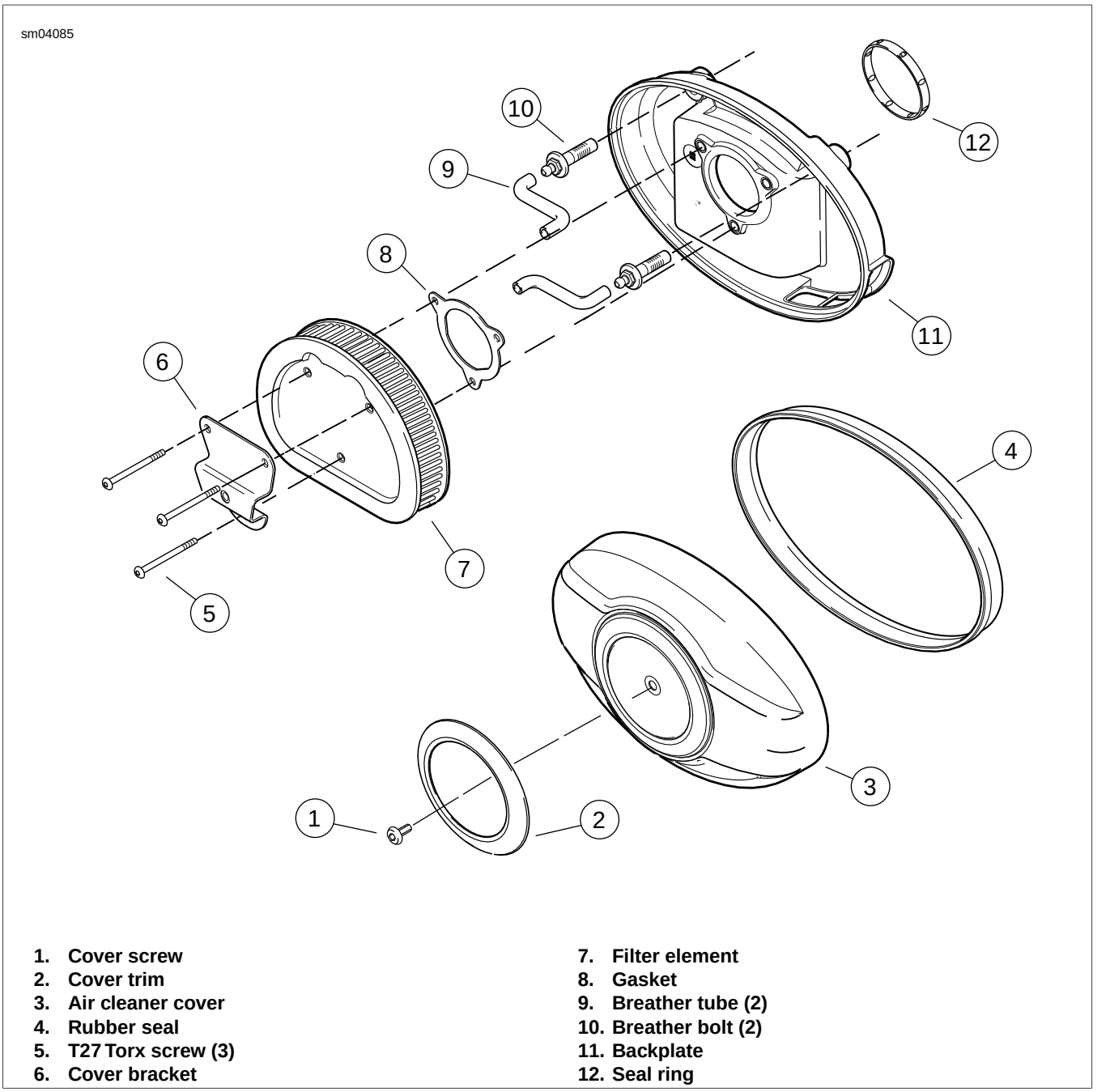
1. With the nubs contacting the ring groove walls, install seal ring on inboard side of backplate.
2. Align holes in backplate with those in cylinder heads and install cylinder head breather bolts. Alternately tighten bolts to 22-24 ft-lbs (29.8-32.5 Nm).
3. Slide **new** gasket over sleeve on inboard side of filter element.
4. Insert breather tubes about 0.25 inch (6.4 mm) into holes on inboard side of filter element.
5. Install breather tubes onto fittings of two cylinder head breather bolts.

NOTE

Air cleaner mounting without installation of the breather tubes allows crankcase vapors to be vented into the atmosphere in violation of legal emissions standards.

6. Place filter element onto backplate with the flat side down.
7. Align holes in cover bracket with those in filter element and start three T27 TORX screws. Alternately tighten screws to 40-60 **in-lbs** (4.5-6.8 Nm).
8. Verify that rubber seal is properly seated around perimeter of air cleaner cover.
9. Fit air cleaner cover into backplate. Apply a small dab of LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (BLUE) to threads of cover screw. Install screw and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).

DIGITAL TECHNICIAN HARLEY



1. **Cover screw**
2. **Cover trim**
3. **Air cleaner cover**
4. **Rubber seal**
5. **T27 Torx screw (3)**
6. **Cover bracket**
7. **Filter element**
8. **Gasket**
9. **Breather tube (2)**
10. **Breather bolt (2)**
11. **Backplate**
12. **Seal ring**

Figure 4-1. Air Cleaner Assembly

FUEL TANK 4.5

REMOVAL

NOTE

The fuel tank can be removed without draining. However, draining is necessary whenever the fuel tank or internal components are serviced.

Purge and Disconnect Fuel Line

⚠WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

NOTE

The gasoline in the fuel supply line is under high pressure: 58 psi (400 kPA). To avoid an uncontrolled discharge or spray of gasoline, always purge the line before disconnecting.

1. Remove left side saddlebag. See 2.29 SADDLEBAGS.
2. Remove left side cover.
3. See Figure 4-2. Remove 15 amp fuel pump fuse.
4. Start the engine and allow the motorcycle to run until engine stalls. Operate starter an additional 3 seconds to remove remaining fuel from fuel supply line.
5. Remove main fuse.
6. Install 15 amp fuel pump fuse.
7. See Figure 4-3. Pull up on chrome sleeve of quick-connect fitting and pull down on fuel supply line fitting to disconnect.

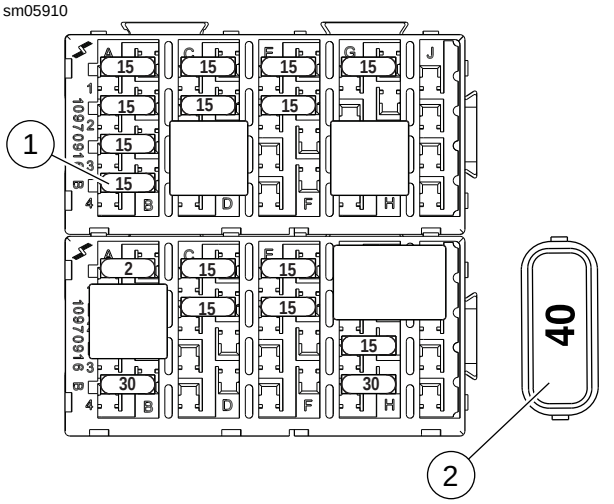
Remove Tank

1. Remove seat. See 2.28 SEAT.
2. Remove console. Proceed as follows:
 a. Remove screw to release front of console from fuel tank weldment.
 b. Remove screw to release rear console bracket from rear fuel tank bracket.
 c. Lay a clean shop towel on forward part of rear fender.
 d. **FLHR/C:** Remove console and lay upside down on shop towel.
 e. **FLHX, FLHT/C/U, FLTR:** Press button to open fuel door on console. Remove filler cap. Remove console and lay upside down on shop towel. Install filler cap.
3. Gently pry fuel vapor vent tube from vapor valve fitting on top plate.
4. Remove fuel level sender/fuel pump connector [141], 4-place Delphi.
5. **FLHR/C models:** Gently pull on convoluted tubing to draw fuel gauge connector out of tunnel at front of fuel tank. Disconnect connector.

⚠WARNING

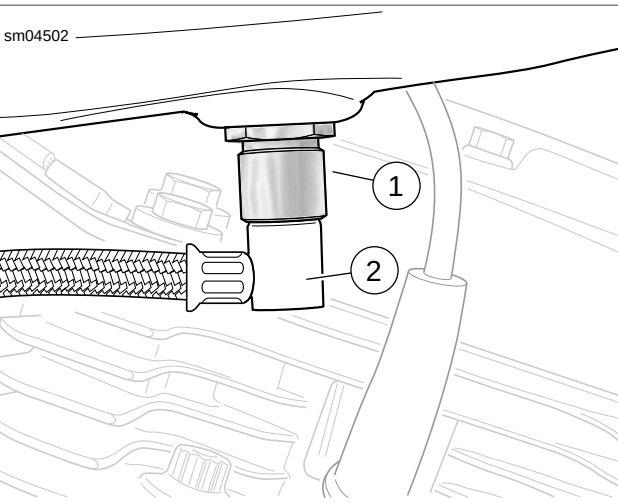
Gasoline can drain from the fuel line when disconnected from fuel tank. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00260a)

6. Remove rubber caps to reveal two front fuel tank screws. Remove screws.
7. Remove two screws to release rear tank bracket from frame backbone.
8. Remove fuel tank from motorcycle.



1. **Fuel pump fuse**
2. **Main fuse**

Figure 4-2. Fuse Blocks



1. **Quick connect fitting (chrome sleeve)**
2. **Fuel supply line fitting**

Figure 4-3. Fuel Tank (Left Side View)

INSTALLATION

1. Install fuel tank onto frame backbone aligning front flange holes with bosses on left and right side of frame.
2. Start front fuel tank fasteners.
3. Secure rear fuel tank bracket to frame backbone. Tighten screws to 15-20 ft-lbs (20.3-27.1 Nm). Install plastic trim cover over bracket.
4. Tighten front fuel tank screws to 15-20 ft-lbs (20.3-27.1 Nm). Install rubber caps over screws. Note that the left and right caps are not interchangeable.

⚠WARNING

To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)

5. Connect quick-connect fitting to fuel tank. While pushing up on bottom of fitting, pull down on chrome sleeve. Tug on fuel line fitting to verify that it is locked in position.
6. **FLHR/C models:** Mate fuel gauge connector. Feed connector into tunnel at front of fuel tank.
7. Connect fuel vapor vent tube to vapor valve fitting on top plate.
8. Install fuel level sender/fuel pump connector [141], 4-place Delphi. For best clearance with cam ring, tilt connector at 35° angle before installation.
9. Install console. Proceed as follows:
 a. **FLHR/C:** Exercising caution to avoid pinching wire harness and vent tube, position console on fuel tank.
 b. **FLHX, FLHT/C/U, FLTR:** Remove filler cap, if installed. Exercising caution to avoid pinching wire harness, fuel overflow hose and vent tube, position console on fuel tank. Install filler cap.
 c. Secure console with front and rear fasteners.
 d. Tighten fasteners to 36-60 **in-lbs** (4.1-6.8 Nm).

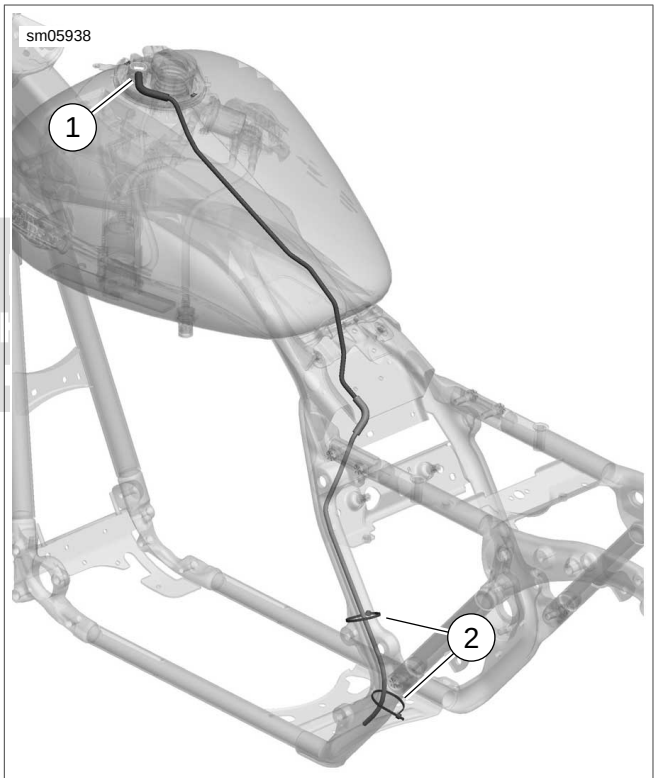
 NOTE

 *If console rear bracket was removed, install bracket and tighten two screws to 20-30 **in-lbs** (2.7-3.4 Nm).*
10. Install seat. See 2.28 SEAT.
11. Install main fuse.
12. Install left side cover.
13. Install left side saddlebag. See 2.29 SADDLEBAGS.

EVAPORATIVE EMISSIONS TUBE: NON-CA MODELS

Removal

1. Remove seat. See 2.28 SEAT.
2. Remove fuel tank console:
 a. Remove screws to release front and rear of console from fuel tank.
 b. Lay a clean shop towel on forward part of rear fender.
 c. **FLHR/C:** Remove console and lay upside down on shop towel.
 d. **FLHX, FLHT/C/U, FLTR:** Remove filler cap. Remove console and lay upside down on shop towel. Install filler cap.
3. See Figure 4-4. Remove vapor tube from fitting (1) on fuel tank top plate.
4. Remove two cable straps (2) securing tube to rear frame downtube.
5. Remove tube from motorcycle.
6. Inspect for deterioration, chaffing, or other damage. Replace as necessary.



1. Fuel vapor vent tube fitting
2. Cable strap

Figure 4-4. Non-California Evaporative System

Installation

1. See Figure 4-4. Route tube down along inner side of rear left downtube. Install two cable straps (2) to secure to frame.
2. Route line along center of fuel tank and connect to fitting (1) on fuel tank top plate.

3. Install fuel tank console:
 a. **FLHR/C:** Position console on fuel tank.
 b. **FLHX, FLHT/C/U, FLTR:** Remove filler cap and position console on fuel tank. Install filler cap.
 c. Verify harnesses and vent tube are not pinched.
 d. Install screws to fasten front and rear of console to fuel tank.
 e. Tighten screws to 36-60 **in-lbs** (4.1-6.8 Nm).
4. Install seat. See 2.28 SEAT.

FUEL SUPPLY CHECK VALVE/TUBE

Removal

NOTE

The in-tank check valve is housed in the quick-connect fitting. The check valve prevents the fuel tank from draining when the external supply line is disconnected.

1. Remove top plate. See 4.6 FUEL TANK TOP PLATE.

⚠WARNING

Gasoline can drain from the fuel line when disconnected from fuel tank. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00260a)

2. Pull up on chrome sleeve and pull down on fuel supply line fitting to disconnect fuel line from tank.
3. See Figure 4-5. Loosen quick-connect fitting.
4. Remove the fitting and fuel supply tube from fuel tank.

Installation

NOTE

Carefully inspect fuel supply tube for cuts, tears, holes or other damage. Replace tube (and quick-connect fitting assembly) if any damage is found.

1. See Figure 4-6. Apply a very light film of clean engine oil to **new** O-ring. Slide O-ring into groove of quick-connect fitting.
2. Feeding fuel supply tube through hole at bottom of fuel tank, hand thread quick-connect fitting into bore.
3. Tighten fitting to 22-26 ft-lbs (29.8-35.3 Nm).

⚠WARNING

To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)

4. Connect quick-connect fitting to fuel tank. While pushing up on bottom of fitting, pull down on chrome sleeve. Tug on fuel line fitting to verify that it is locked in position.
5. Install top plate. See 4.6 FUEL TANK TOP PLATE.

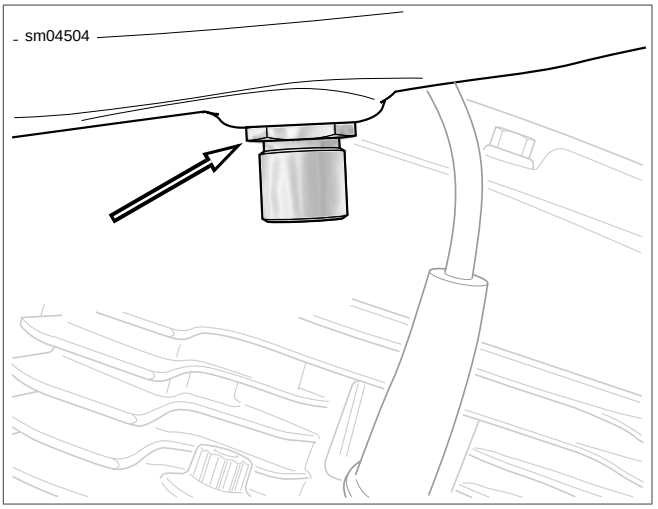
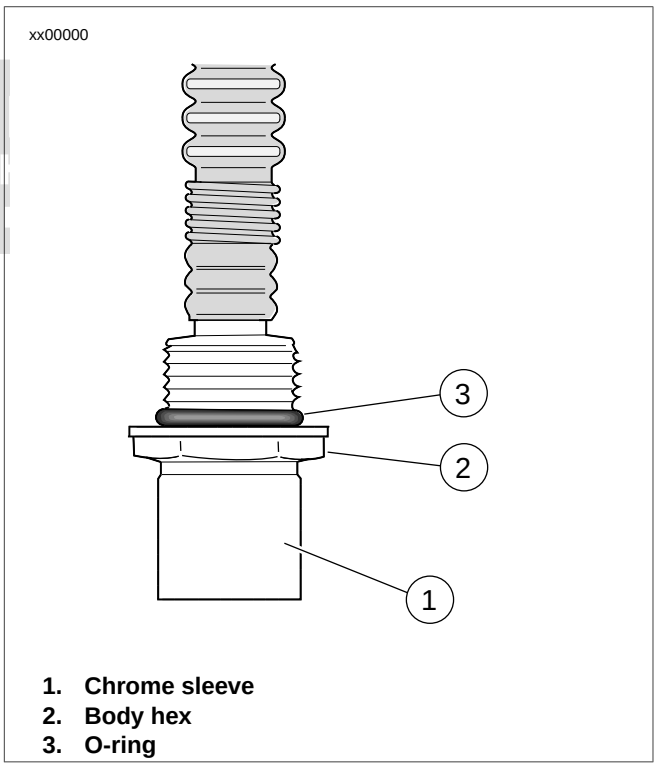


Figure 4-5. Engage Hex on Quick-Connect Fitting



1. **Chrome sleeve**
2. **Body hex**
3. **O-ring**

Figure 4-6. Fuel Supply Check Valve/Tube

FUEL TANK TOP PLATE 4.6

REMOVAL

PART NUMBER	TOOL NAME
HD-48646	CAM RING REMOVER/INSTALLER

NOTE

The gasoline in the fuel supply line is under high pressure (58 psi (400 kPa)). To avoid an uncontrolled discharge or spray of gasoline, always purge the line before top plate removal.

1. Disconnect fuel supply line from tank. See 4.6 FUEL TANK TOP PLATE, Removal.
2. Remove filler cap and drain fuel tank. Use a common pump or siphon and an approved gasoline storage container of sufficient capacity.
3. Remove seat. See 2.28 SEAT.
4. Remove console. Proceed as follows:
 a. Remove screw to release front of console from fuel tank weldment.
 b. Remove screw to release rear console bracket from rear fuel tank bracket.
 c. Lay a clean shop towel on forward part of rear fender.
 d. **FLHR/C:** Remove console and lay upside down on shop towel.
 e. **FLHX, FLHT/C/U, FLTR:** Press button to open fuel door on console. Remove filler cap. Remove console and lay upside down on shop towel. Install filler cap.
5. See Figure 4-7. Place CAM RING REMOVER/INSTALLER (Part No. HD-48646) over top plate aligning four notches at bottom with four tabs on cam ring.
6. Rotate in a counter-clockwise direction until cam ring is free.

NOTE

See Figure 4-8. Always hold onto both the Cam Ring Remover/Installer and ratchet during handling or separation of parts may cause one to be dropped, possibly resulting in hard contact with fuel tank.

7. Remove cam ring and raise top plate.
8. Remove connector at bottom of top plate. For best results, insert small flat blade screwdriver between latch and top plate. Depress either side of latch while gently tugging on harness.
9. See Figure 4-9. Disconnect ground wire spade terminal from slot of top plate.
10. Depress collars to remove tubes from fittings on fuel filter shell.
11. See Figure 4-10. If top plate replacement is necessary, remove fuel filter shell. See 4.7 FUEL FILTER.

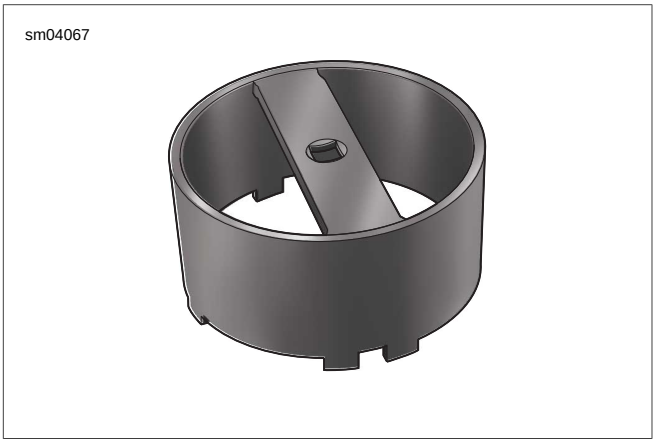


Figure 4-7. Cam Ring Remover/Installer (HD-48646)

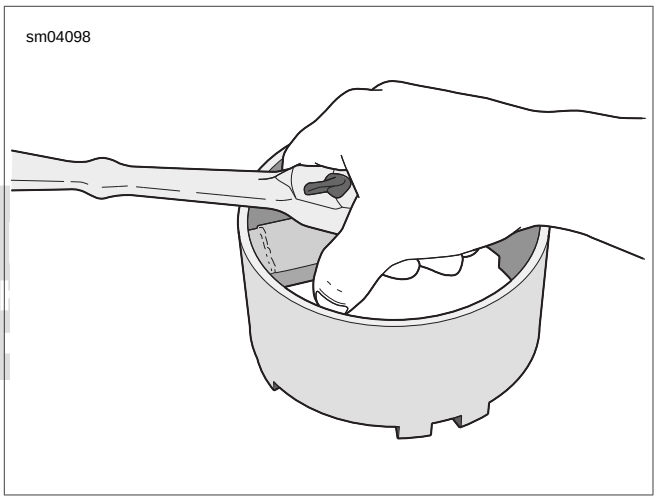
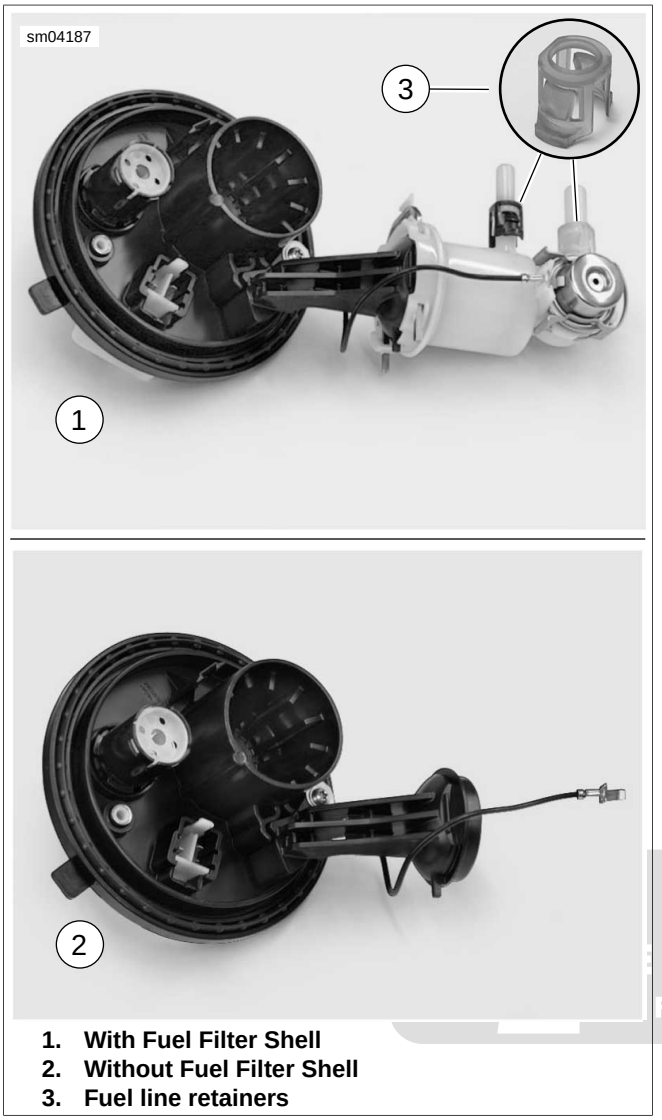


Figure 4-8. Hold Both Tool and Ratchet During Handling



Figure 4-9. Remove Ground Wire Spade Terminal From Top Plate



1. **With Fuel Filter Shell**
2. **Without Fuel Filter Shell**
3. **Fuel line retainers**

Figure 4-10. Top Plate Assembly

INSTALLATION

PART NUMBER	TOOL NAME
HD-48646	CAM RING REMOVER/INSTALLER

1. If installing a **new** top plate, first install fuel filter shell. See 4.7 FUEL FILTER.
2. Inspect seal ring at bottom of top plate for cuts, tears or signs of deterioration. If necessary, install **new** seal ring with the nubs contacting the ring groove walls.
3. See Figure 4-10. Verify retainers (3) are secure on fuel filter fittings, and that they are not damaged. Note that retainers are of different sizes to prevent improper assembly.
4. Aligning latches in retainers and tubes, push tubes onto fittings of fuel filter shell until an audible click is heard. Note that fittings are of different sizes to prevent improper assembly. Pull on tubes to verify they are attached securely.
5. Install connector at bottom of top plate.
6. Route ground wire (from top plate connector) along inboard side of vapor valve and install spade terminal into slot in top plate.
7. Install fuel tank top plate engaging index tab on OD in slot at front of fuel tank collar.
8. See Figure 4-11. Install cam ring over fuel tank top plate with the TOP stamp up.

NOTE

Remove filler cap from top plate on fairing equipped models.

9. Place CAM RING REMOVER/INSTALLER (Part No. HD-48646) over top plate aligning four notches with tabs on cam ring. Pushing down on tool with both hands, rotate in a clockwise direction until each of four index tabs begin to engage slots in fuel tank collar.
10. Install 1/2 inch drive ratchet and continue rotation of tool until cam ring is fully installed.

NOTE

See Figure 4-8. Always hold onto both the Cam Ring Remover/Installer and ratchet during handling or separation of parts may cause one to be dropped, possibly resulting in hard contact with fuel tank.

11. Install console. Proceed as follows:
 a. **FLHR/C:** Exercising caution to avoid pinching wire harness and vent tube, position console on fuel tank.
 b. **FLHX, FLHT/C/U, FLTR:** Remove filler cap, if installed. Exercising caution to avoid pinching wire harness, fuel overflow hose and vent tube, position console on fuel tank. Install filler cap.
 c. Secure console with front and rear fasteners.
 d. Tighten fasteners to 36-60 **in-lbs** (4.1-6.8 Nm).
12. Install seat. See 2.28 SEAT.
13. Install main fuse.
14. Install left side cover.
15. Install left side saddlebag. See 2.29 SADDLEBAGS.

⚠WARNING

Wipe up spilled fuel and dispose of rags in a suitable manner. An open spark around gasoline could cause a fire or explosion, resulting in death or serious injury. (00518b)

16. Fill fuel tank. Carefully inspect for leaks. Start engine and repeat inspection.

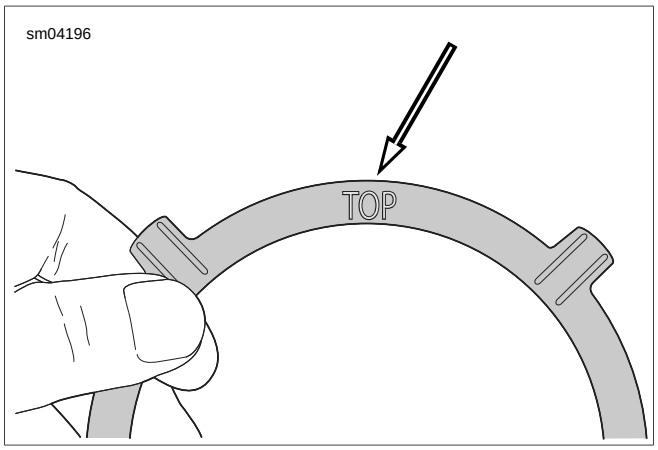


Figure 4-11. Cam Ring Stamp

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FUEL FILTER 4.7

REMOVAL

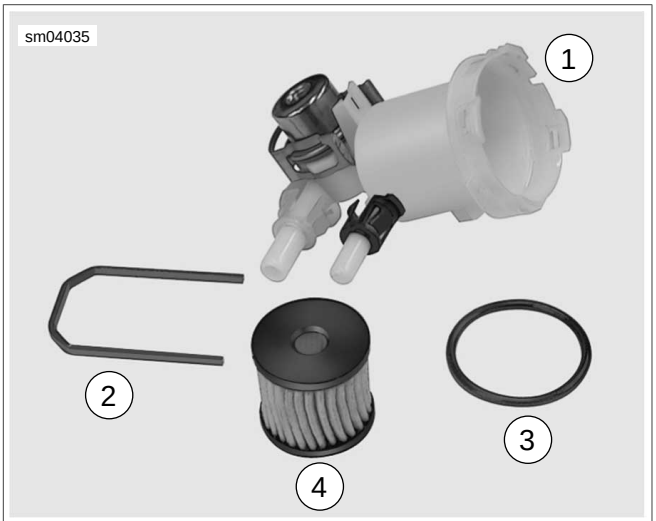
⚠WARNING

Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

1. Remove top plate. See 4.6 FUEL TANK TOP PLATE.
2. Locate ground wire spade terminal in slot of fuel filter shell. Insert tip of small flat blade screwdriver through window to press tang, and then pull terminal from slot. See Figure 4-12.
3. Gently raise locking arm and pull U-clip from holes in fuel filter shell.
4. Remove fuel filter shell from end cap.
5. Remove O-ring and filter from fuel filter shell. See Figure 4-13.



Figure 4-12. Remove Ground Wire Spade Terminal From Fuel Filter Shell



1. **Filter shell**
2. **U-clip**
3. **O-ring**
4. **Filter**

Figure 4-13. Fuel Filter Assembly

INSTALLATION

1. Install **new** filter in fuel filter shell.
2. Seat O-ring on counterbore at top of filter.
3. Install fuel filter shell over end cap, so that slot in fuel filter shell engages index pin on end cap.
4. Holding parts together, slide U-clip through holes on locking arm side of fuel filter shell. Push U-clip until ends exit holes on opposite side. Retract U-clip until contact is made with step in locking arm.
5. Route ground wire (from top plate TORX screw) around index pin side of end cap and install spade terminal into slot in fuel filter shell. Gently tug on wire to verify that terminal is locked.

NOTE

If terminal does not lock, use a thin flat blade, like that on a hobby knife, to bend tang outward slightly away from terminal body.

6. Install top plate. See 4.6 FUEL TANK TOP PLATE.

FUEL PRESSURE REGULATOR 4.8

REMOVAL

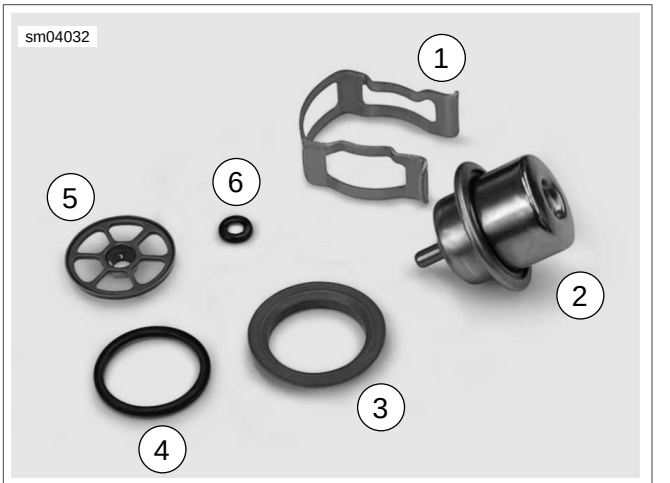
⚠WARNING

Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

1. Remove top plate. See 4.6 FUEL TANK TOP PLATE.
2. See Figure 4-14. Remove ground wire spade terminal from slot of fuel filter shell.
3. Remove spring clip from fuel pressure regulator. For best results, free one side first and then the other.
4. See Figure 4-15. Remove fuel pressure regulator, regulator seat, large O-ring, screen and small O-ring.



Figure 4-14. Remove Ground Wire Spade Terminal From Fuel Filter Shell



1. **Spring clip**
2. **Fuel pressure regulator**
3. **Regulator seat**
4. **Large O-ring**
5. **Screen**
6. **Small O-ring**

Figure 4-15. Fuel Pressure Regulator Assembly

INSTALLATION

1. Insert small O-ring at top of pressure port bore.
2. Install screen at top of pressure regulator bore, so that sleeve on ID faces small O-ring. Install regulator seat to evenly press screen into bore. Remove regulator seat.
3. Install large O-ring at top of screen.
4. Install regulator seat and fuel pressure regulator.
5. Install spring clip, so that indented sides engage top of center rib on fuel pressure regulator, while rounded side engages bottom of tabs on housing.
6. Route ground wire around index pin side of end cap and install spade terminal into slot in fuel filter shell.
7. Install top plate. See 4.6 FUEL TANK TOP PLATE.

FUEL LEVEL SENDER 4.9

REMOVAL

⚠WARNING

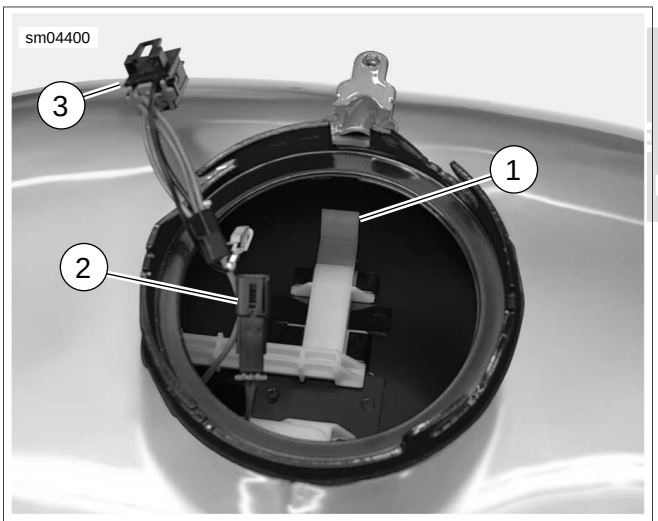
Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

1. Remove top plate. See 4.6 FUEL TANK TOP PLATE.
2. Disconnect 2-place connector to release fuel level sender from wire harness.

NOTE

Looking into fuel tank at bracketry at top of tunnel, note that finger on front bracket points forward, while finger on rear bracket points rearward. See Figure 4-16.

3. Reaching into fuel tank, pull up on front finger and slide fuel level sender bracket rearward until four ears on bracket are free of catches at top of tunnel.
4. Remove fuel level sender from left side of fuel tank. See Figure 4-17.



1. **Fuel level sender bracket (front finger)**
2. **Fuel level sender connector**
3. **Top plate connector**

Figure 4-16. Front Finger (Fuel Level Sender Bracket)

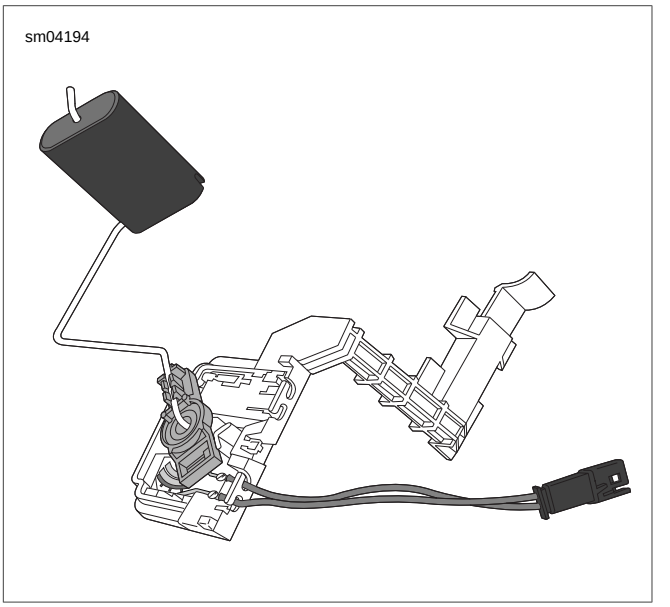


Figure 4-17. Fuel Level Sender

INSTALLATION

1. With the finger on the fuel level sender bracket pointing forward, install fuel level sender into left side of fuel tank.
2. Engage four ears on fuel level sender bracket with front set of catches at top of tunnel. Push fuel level sender bracket forward until ears are fully engaged.
3. Connect 2-place connector to attach fuel level sender to wire harness.
4. Install top plate. See 4.6 FUEL TANK TOP PLATE.

TWIST GRIP SENSOR 4.10

REMOVAL

1. Remove left side saddlebag. See 2.29 SADDLEBAGS.
2. Remove left side cover.
3. Remove main fuse.

NOTE

Do not remove the switch housing assembly without first placing the 5/32 inch (4.0 mm) cardboard insert between the brake lever and lever bracket. Removal without the insert may result in damage to the rubber boot and plunger of the front stoplight switch. Use the eyelet of an ordinary cable strap if the cardboard insert is not available.

4. Place the cardboard insert between the brake lever and lever bracket.
5. Remove the upper and lower switch housing screws.
6. Loosen the upper screw securing the handlebar clamp to the master cylinder housing. Remove the lower clamp screw with flat washer.
7. Separate the upper and lower switch housings and remove the throttle grip from the end of the handlebar.

NOTE

To remove the throttle grip, a slight tug may be necessary to release index pins in grip from receptacle in seal cap of twist grip sensor.

8. If present, pull two cable clips on right side handlebar switch conduit from holes in handlebar.
9. **FLHR/C:** See Figure 4-18. Remove headlamp and handlebar clamp shroud. See 2.47 HEADLAMP NACELLE: FLHR/C. Remove twist grip sensor jumper harness connector [204], 6-place Molex (black), from T-stud on fork stem nut lock plate (right side) and disconnect.
10. **FLHX, FLHT/C/U:** See Figure 4-19. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U. Remove twist grip sensor jumper harness connector [204], 6-place Molex (black), from T-stud at top of right fairing support brace (inboard side) and disconnect.
11. **FLTR:** Remove outer fairing and bezel. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR and 2.42 INSTRUMENT BEZEL: FLTR, respectively. Disconnect twist grip sensor jumper harness connector [204], 6-place Molex (black).

NOTE

The external latch on the pin housing of the twist grip sensor connector will break if the twist grip sensor is pulled too hard. A damaged latch prevents positive engagement of the pin and socket housings. Since the connector is not serviceable, any damage requires replacement of the twist grip sensor jumper harness.

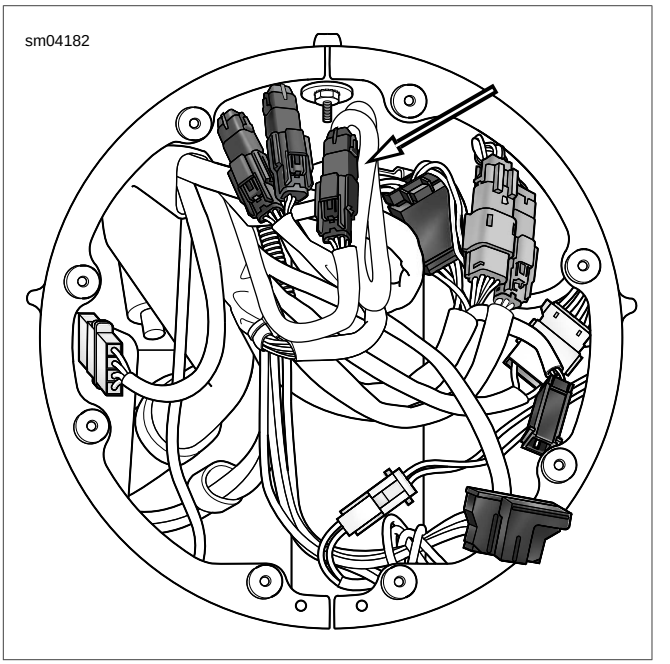


Figure 4-18. Twist Grip Sensor Jumper Harness Connector (FLHR/C)

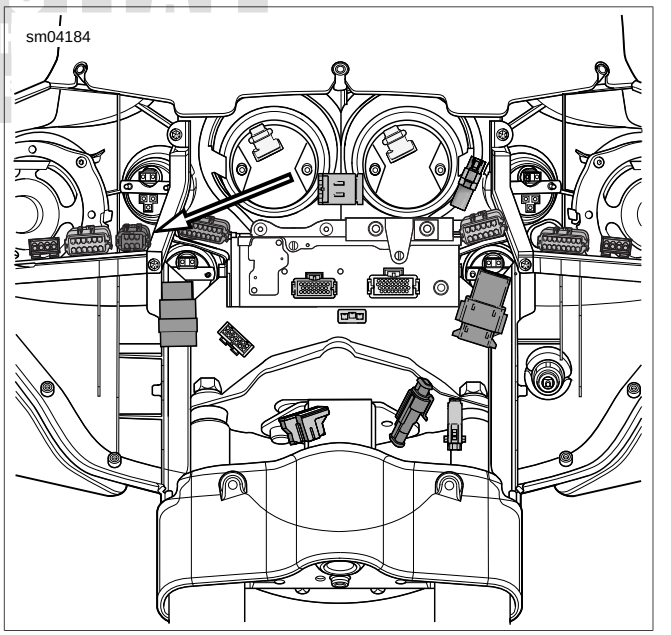


Figure 4-19. Twist Grip Sensor Jumper Harness Connector (FLHX, FLHT/C/U)

12. Gently pull twist grip sensor out of handlebar only as far as necessary to access green twist grip sensor connector. For best results, proceed as follows:
 a. Straighten conduit on Molex connector end of jumper harness and feed through slot at front of handlebar while pulling.
 b. If harness sticks inside handlebar while pulling twist grip sensor, pull Molex connector end to retract harness slightly, and then try again; gently work harness back and forth in this manner until twist grip sensor connector is accessible.

NOTE

The external latch on the pin housing of the twist grip sensor connector will break if pried. A damaged latch prevents positive engagement of the pin and socket housings. Since the connector is not serviceable, any damage requires replacement of the twist grip sensor jumper harness.

13. Gently insert a small flat blade screwdriver between pin and socket housings as shown in Figure 4-20. Once bottom edge of latch is engaged, separate housings. Do not pivot or rotate screwdriver after insertion or damage to pin housing will occur.
14. See Figure 4-21. Remove twist grip sensor.

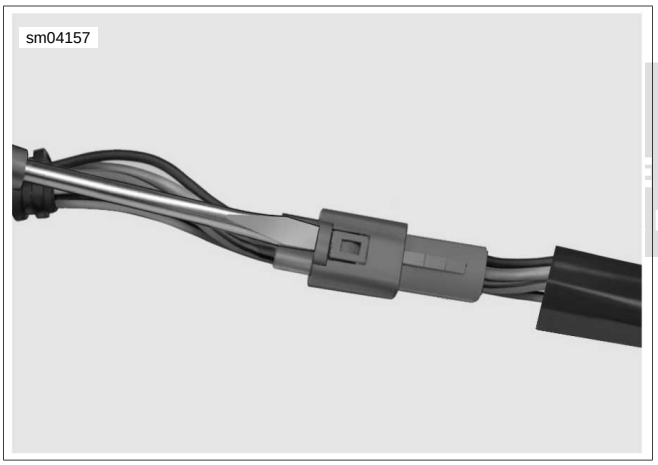


Figure 4-20. Gently Insert Screwdriver to Disconnect Twist Grip Sensor Connector



Figure 4-21. Twist Grip Sensor

INSTALLATION

NOTE

Each twist grip sensor contains the terminals for installation of a heated throttle grip available through P&A. While the seal cap protects the terminals from dirt and moisture, it also serves as a retention device for installation of the throttle grip.

1. Verify that seal cap is installed at end of twist grip sensor. If seal cap is not present, proceed as follows:
 a. See if seal cap is engaged on index pins inside throttle grip. If found, use a stiff piece of mechanics wire to lasso seal cap and pull free of index pins. Obtain **new** seal cap if damaged or missing.
 b. Check condition of O-ring on seal cap. As O-ring is not sold separately, install **new** seal cap if O-ring replacement is necessary.
 c. See Figure 4-22. Install seal cap engaging legs in slots at end of twist grip sensor. For best results, install one leg first. Depressing second leg slightly with a small flat blade screwdriver, push down on seal cap until fully installed.
2. Connect green twist grip sensor connector.
3. See Figure 4-23. Gently pull Molex connector end of jumper harness to draw twist grip sensor into handlebar. Fit index tabs on twist grip sensor into slots in handlebar. One index tab and slot are smaller than the others to prevent improper assembly.
4. Slide the throttle grip over the end of the handlebar. Rotate the grip to verify that internal splines are engaged with those on the twist grip sensor.

NOTE

It is not necessary to hold the throttle grip onto the handlebar. Index pins in grip engage receptacle in seal cap of twist grip sensor to prevent grip from sliding off.

5. Position the lower switch housing beneath the throttle grip, so that ribs at end of throttle grip engage slot in lower switch housing.
6. Position the upper switch housing over the handlebar and lower switch housing.
7. Start the upper and lower switch housing screws, but do not tighten. Verify that the wire harness conduit runs in depression at bottom of handlebar.
8. Position the brake lever/master cylinder assembly inboard of the switch housing assembly engaging the tab on the lower switch housing in the groove at the top of the brake lever bracket.
9. Align the holes in the handlebar clamp with those in the master cylinder housing and start the lower screw (with flat washer). Position for rider comfort.

NOTE

Do not pull the switch housings so far inboard as to cause the throttle grip to bind or drag on the handlebar. Rotate the throttle grip to verify that it freely returns to the idle position.

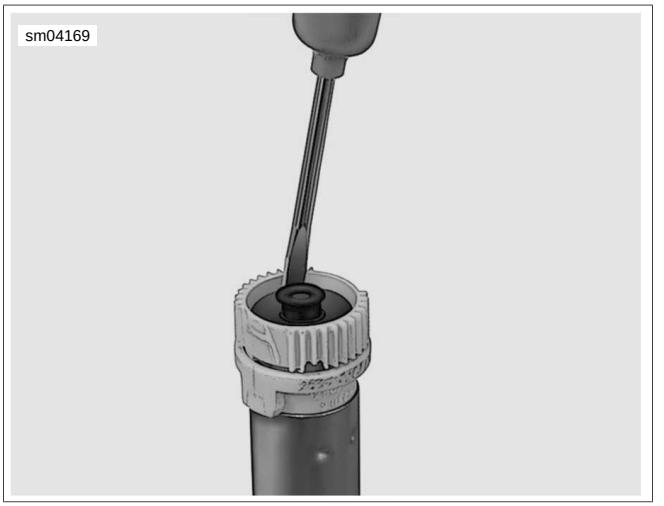


Figure 4-22. Install Seal Cap If Removed



Figure 4-23. Install Twist Grip Sensor

10. Beginning with the top screw, tighten the handlebar clamp screws to 72-80 **in-lbs** (8-9 Nm).

NOTE

Always tighten the lower switch housing screw first, so that any gap between the upper and lower housings is at the front of the switch assembly.

11. Tighten the lower and upper switch housing screws to 35-45 **in-lbs** (4-5 Nm).
12. Remove the cardboard insert between the brake lever and lever bracket.
13. **FLHR/C:** Connect twist grip sensor jumper harness connector and install on T-stud on fork stem nut lock plate (right side). Install handlebar clamp shroud and headlamp. See 2.47 HEADLAMP NACELLE: FLHR/C.
14. **FLHX, FLHT/C/U:** Draw twist grip sensor jumper harness connector and conduit forward to front of upper fork bracket, and then route under right radio support bracket to area behind fairing support brace. Connect connector and install on T-stud at top of fairing support brace (inboard side). Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
15. **FLTR:** Connect twist grip sensor jumper harness connector. Install outer fairing and bezel. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR and 2.42 INSTRUMENT BEZEL: FLTR, respectively.
16. If present, install two cable clips on right side handlebar switch conduit into holes in handlebar.
17. Install main fuse.
18. Install left side cover.
19. Install left side saddlebag. See 2.29 SADDLEBAGS.

NOTE

*Whenever a **new** twist grip sensor (or ECM) is installed, place the engine run/stop switch in the RUN position and turn the ignition/light keyswitch to IGNITION and then back to OFF four times (without starting engine). Allow at least three seconds to elapse between ignition cycles. As the ECM uses the first four ignition cycles to establish the optimum idle speed, there may be initial performance problems if the procedure is not performed, such as high idle or hesitation when the throttle is opened.*

20. Turn the ignition/light key switch to IGNITION and apply brake lever to test operation of brake lamp.

TWIST GRIP SENSOR JUMPER HARNESS

Removal

1. Remove twist grip sensor.
2. Obtain length of strong flexible mechanics wire.

NOTE

Be sure that mechanics wire is of sufficient strength to pull conduit and connector through handlebar without breaking. Wire length must also be long enough, so that free end is not lost in handlebar when pulled.

3. See Figure 4-24. Securely attach mechanics wire to jumper harness inboard of twist grip sensor connector pin housing. For best results, install mechanics wire on conduit to keep it from bunching up inside handlebar when pulled.
4. Gently pull Molex connector end of jumper harness to draw conduit, connector and mechanics wire out through slot at front of handlebar. If harness sticks inside handlebar, pull on twist grip sensor connector end to retract harness slightly, and then try again; gently work harness back and forth in this manner until free. Remove mechanics wire from jumper harness.

Installation

1. Securely attach mechanics wire to jumper harness inboard of twist grip sensor connector pin housing. For best results, install mechanics wire on conduit to keep it from bunching up inside handlebar when pulled.

2. Gently draw connector and conduit back through handlebar. For best results, proceed as follows:
 a. Guide leading edge of connector and conduit through slot at front of handlebar. Keep harness straight and feed through slot while pulling.
 b. If harness sticks inside handlebar, pull Molex connector end to retract it slightly, and then try again; gently work harness back and forth in this manner until twist grip sensor connector is accessible.
3. Remove mechanics wire from jumper harness.
4. Install twist grip sensor.

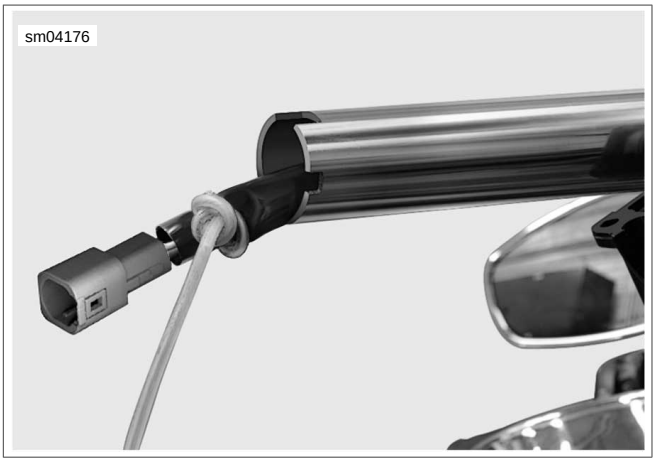


Figure 4-24. Fix Mechanics Wire to Twist Grip Sensor Jumper Harness

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

THROTTLE CONTROL ACTUATOR (TCA) 4.11

GENERAL

NOTE

See Figure 4-25. The TCA is not sold separately. Damage or failure requires complete replacement of the induction module. Also note that tampering or removing TCA cover voids warranty.

Refer to the electrical diagnostic manual for information on the function and testing of the TCA.

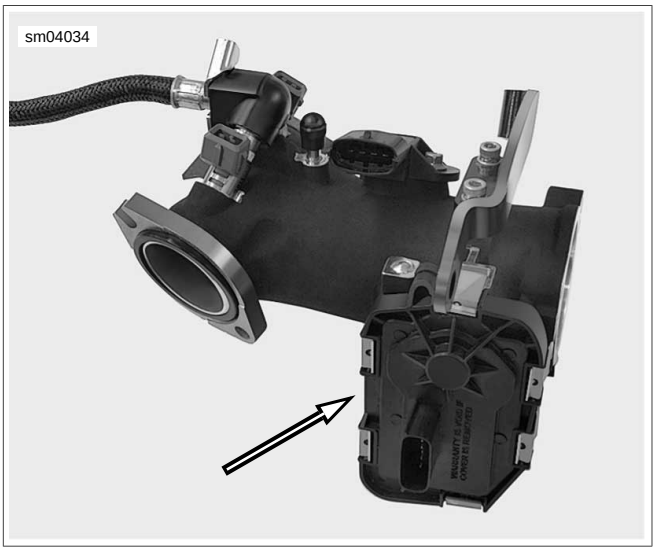


Figure 4-25. TCA

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

ENGINE TEMPERATURE SENSOR (ET) 4.12

REMOVAL

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Loosen horn bracket bolt to front cylinder head. Remove horn bracket bolt (with flat washer) from rear cylinder head and swing horn bracket forward.
3. Pull back boot at back of front cylinder and remove ET sensor connector [90].
4. See Figure 4-26. Remove sensor.

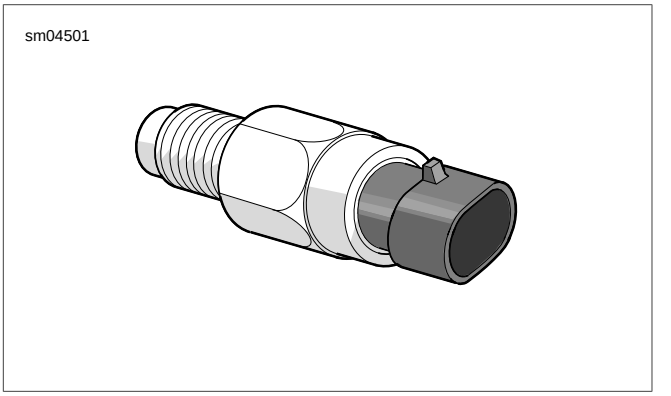


Figure 4-26. ET Sensor

INSTALLATION

1. Hand start **new** ET sensor into bore at back of front cylinder.
2. Tighten to 120-180 **in-lbs** (13.6-20.3 Nm).
3. Install ET sensor connector [90]. Pull boot over connector.
4. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

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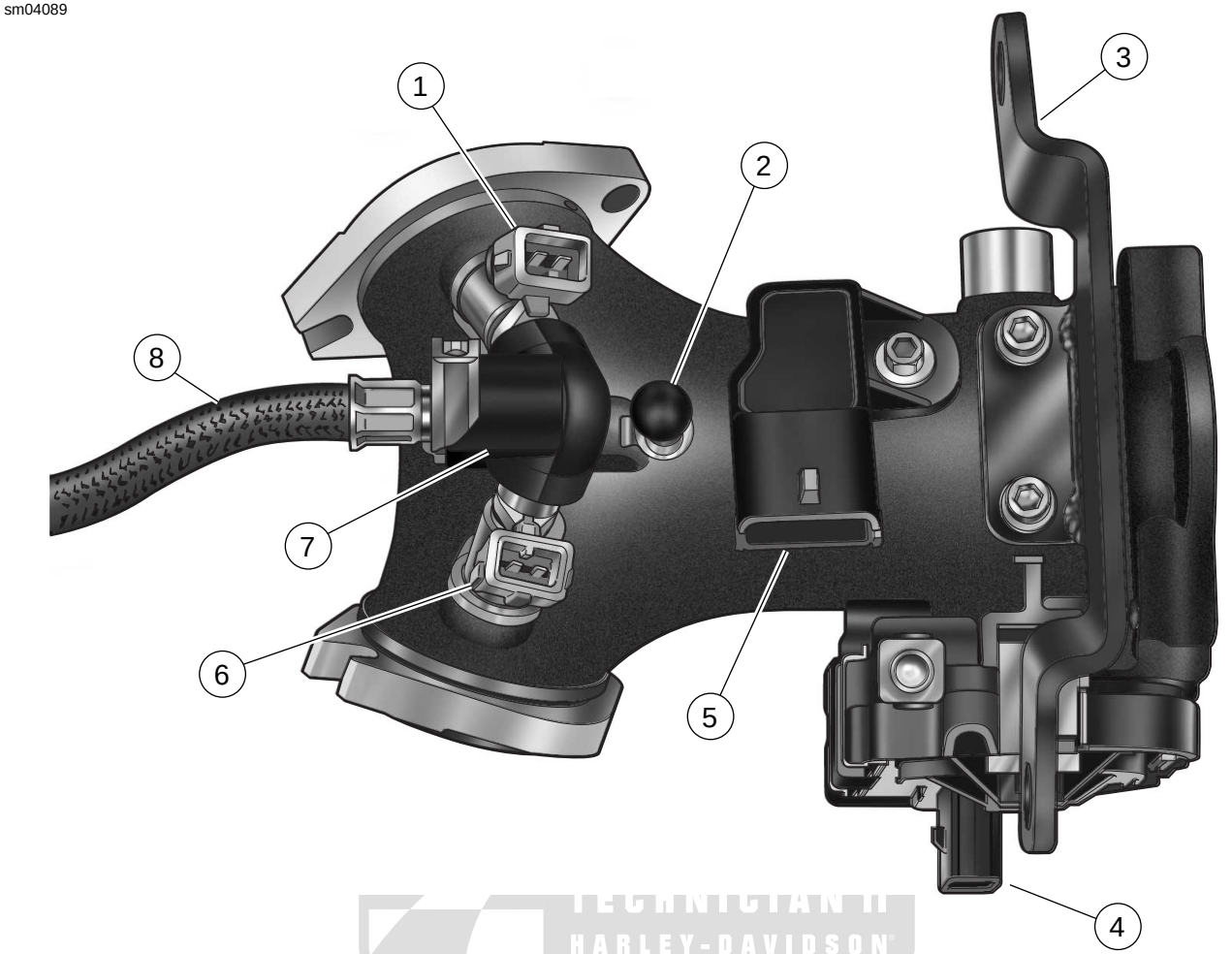
INDUCTION MODULE 4.13

REMOVAL

PART NUMBER	TOOL NAME
HD-47250	INTAKE MANIFOLD WRENCH

1. Remove fuel tank. See 4.5 FUEL TANK.
2. Remove air cleaner and backplate. See 4.4 AIR CLEANER ASSEMBLY.
3. See Figure 4-27. Pull purge tube from fitting (2) at top of induction module (California models only).
4. Remove TMAP sensor connector (5).
5. Remove front fuel injector connector (1) and rear fuel injector connector (6).
6. Remove TCA connector (4). Cut anchored cable strap to release connector conduit from front right side of induction module.
7. Remove right side screws from front and rear cylinder head flange adapters. For best results, use the INTAKE MANIFOLD WRENCH (Part No. HD-47250). See Figure 4-28.
8. Loosen left side screws from flange adapters. Slots in flanges make removal of screws unnecessary. For best access, proceed as follows:
 a. Loosen horn bracket screw to front cylinder head. Remove horn bracket screw (with flat washer) from rear cylinder head and swing horn bracket forward.
 b. Disconnect terminals from horn spade contacts and release harness conduit from J-clamp.
 c. Remove ET sensor connector [90].
9. Slide induction module out right side of motorcycle.
10. Remove seals from flange adapters. Discard seals. Remove flange adapters from outlet ports of induction module.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Front fuel injector [84]**
2. **Purge tube fitting/cap**
3. **Mounting bracket**
4. **TCA [211]**
5. **TMAP sensor [80]**
6. **Rear fuel injector [85]**
7. **Fuel rail**
8. **Fuel supply tube**

Figure 4-27. Induction Module Assembly

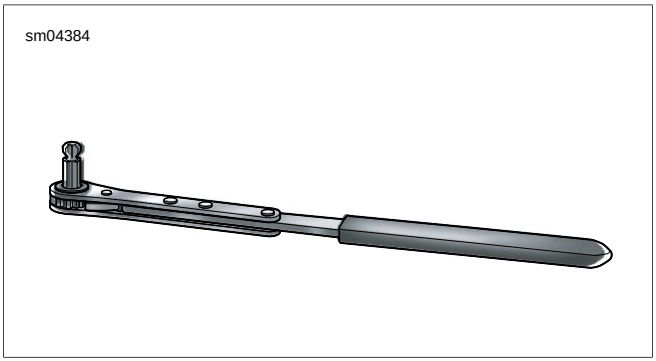


Figure 4-28. Intake Manifold Wrench

INSTALLATION

PART NUMBER	TOOL NAME
HD-47250	INTAKE MANIFOLD WRENCH

1. With the counterbore facing outward, slide cylinder head flange adapters onto outlet ports of induction module.
2. Place a **new** seal in each flange adapter with the beveled side in against the counterbore.
3. Orient the induction module as shown in Figure 4-27. Slide induction into position so that open-ended slots on flange adapters engage socket screws on left side.
4. Start right side screws. For best results, use the INTAKE MANIFOLD WRENCH (Part No. HD-47250).
5. Use mounting bracket to properly locate induction module. Start two breather bolts to fasten mounting bracket to front and rear cylinder heads.

6. Tighten right side flange adapter screws until snug. Tighten left side screws to 96-144 **in-lbs** (10.9-16.3 Nm).
7. Tighten right side screws to 96-144 **in-lbs** (10.9-16.3 Nm).
8. If parts were removed for access to left side flange adapter screws, proceed as follows:
 a. Install ET sensor connector [90] at back of front cylinder. Pull boot over sensor.
 b. Install terminals onto horn spade contacts. Capture harness conduit in J-clamp.
 c. Fasten horn bracket to rear cylinder head. Tighten front and rear horn bracket screws to 35-40 ft-lbs (48-54 Nm).
9. Remove breather bolts to release mounting bracket from front and rear cylinder heads.
10. See Figure 4-27. Install rear fuel injector connector (6) and front fuel injector connector (1).
11. Install TMAP sensor connector (5).
12. Route TCA connector and conduit straight down between induction module and front cylinder staying inboard of mounting bracket. Install **new** anchored cable strap in hole at front right side of induction module and loosely capture TCA conduit.
13. Route conduit rearward under induction module and install TCA connector (4). Tighten cable strap and cut any excess cable strap material.
14. Connect purge tube to fitting (2) (California models only). On non-California models, inspect rubber cap for tears, cracks or signs of deterioration. Replace cap if damaged or missing.
15. Install fuel tank. See 4.5 FUEL TANK.
16. Install backplate and air cleaner. See 4.4 AIR CLEANER ASSEMBLY.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TEMPERATURE MANIFOLD ABSOLUTE PRESSURE SENSOR (TMAP) 4.14

GENERAL

Refer to the electrical diagnostic manual for information on the function and testing of the temperature/manifold absolute pressure (TMAP) sensor.

REMOVAL

1. Remove fuel tank. See 4.5 FUEL TANK.
2. Remove hex screw to release TMAP sensor bracket from induction module. Discard screw.
3. See Figure 4-29. While rotating TMAP sensor slightly, pull straight up to release pressure port from hole in induction module.

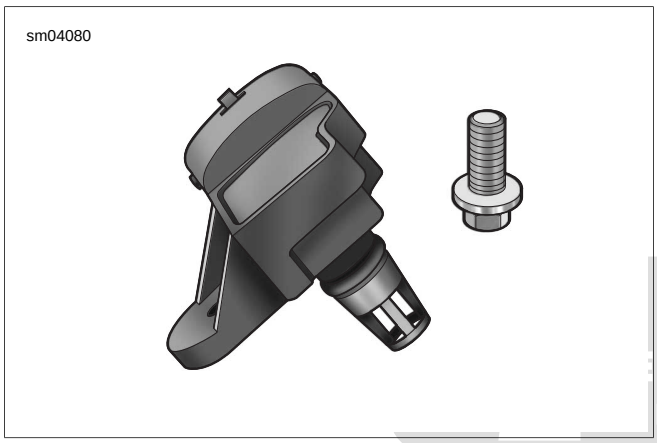


Figure 4-29. TMAP Sensor

INSTALLATION

1. Inspect O-ring on pressure port for cuts, tears or signs of deterioration. Install **new** O-ring if necessary.
2. With the electrical connector facing toward the rear of the induction module, insert pressure port on TMAP sensor into hole in induction module.
3. Align hole in TMAP sensor bracket with threaded hole in induction module.
4. Install **new** hex screw and tighten to 84-108 **in-lbs** (9.5-12.2 Nm).
5. Install fuel tank. See 4.5 FUEL TANK.

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OXYGEN SENSORS (O2) 4.15

GENERAL

Refer to the electrical diagnostic manual for information on the function and testing of the oxygen sensor (O2).

REMOVAL

PART NUMBER	TOOL NAME
HD-48262	O2 SENSOR SOCKET

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. **Front Exhaust Header:** Cut cable straps and disconnect front O2 sensor connector [138], 2-place Amp (Tyco), behind cross brace between front frame downtubes.
3. **Rear Exhaust Header:** Disconnect rear O2 sensor connector [137], 2-place Amp (Tyco), under starter.
4. See Figure 4-31. Remove O2 sensor using O2 SENSOR SOCKET (Part No. HD-48262) with drive extension.

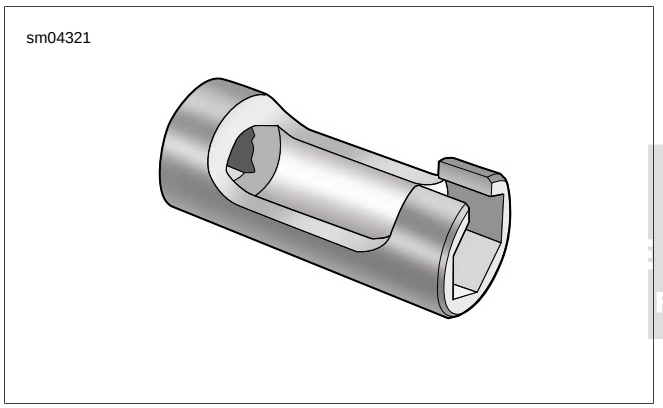


Figure 4-30. O2 Sensor Socket (HD-48262)



Figure 4-31. Remove/Install Front O2 Sensor

INSTALLATION

PART NUMBER	TOOL NAME
HD-48262	O2 SENSOR SOCKET

NOTES

- *Do not install sensors that have been dropped or impacted by other components. Damage to the sensing element may have occurred.*
- *Replacement sensors have anti-seize pre-applied to the threads. Apply a thin coat of anti-seize lubricant to the threads of sensors that are to be reused. Never use any other lubricant or sealant.*

1. If reusing O2 sensor, install **new** seal washer and apply a light coating of anti-seize lubricant to threads.
2. Start O2 sensor into threaded boss on exhaust header.
3. Using O2 SENSOR SOCKET (Part No. HD-48262), tighten to 30-44 ft-lbs (40.7-59.7 Nm).

NOTE

Verify connector halves are clean and free of grease or other contaminants. NEVER apply dielectric grease, cleaning agents, or any other lubricants, sealants or fluids to O2 sensor connectors. Any such application will result in signal trouble and sensor failure.

4. **Front Exhaust Header:** Connect front O2 sensor connector [138], 2-place Amp (Tyco). Secure connector and harnesses to back of cross brace with **new** cable straps.
5. **Rear Exhaust Header:** Connect rear O2 sensor connector [137], 2-place Amp (Tyco), and tuck under starter.
6. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

FUEL INJECTORS 4.16

GENERAL

⚠WARNING

Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

Refer to the electrical diagnostic manual for information on the function and testing of the fuel injectors.

REMOVAL

1. Remove induction module. See 4.13 INDUCTION MODULE.
2. Remove T25 TORX screw to release fuel supply tube clamp from fuel rail.
3. See Figure 4-32. Rotate fuel supply tube clamp 90 degrees in a clockwise direction and then remove from groove in fuel supply tube fitting.
4. Pull fuel supply tube from fuel rail bore and remove two O-rings and two sealing washers. Discard O-rings and sealing washers.
5. Pull fuel injectors with attached fuel rail from induction module. To overcome the resistance of the bottom O-ring on both fuel injectors, gently rock assembly back and forth while pulling.
6. Pull fuel injectors from fuel rail. To overcome the resistance of the top O-ring, gently rock each fuel injector while pulling.
7. Remove O-rings from fuel injectors. Discard O-rings.

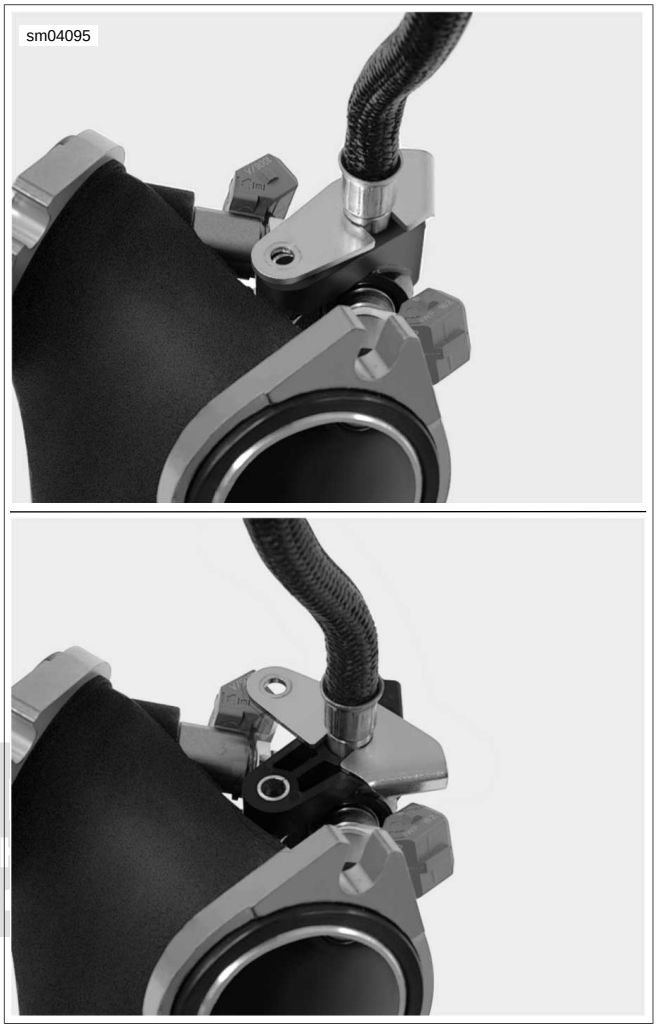


Figure 4-32. Rotate Fuel Supply Tube Clamp

INSTALLATION

1. Apply a very light film of clean engine oil to **new** O-rings. Install O-rings on fuel injectors.
2. Push open end of fuel injectors (opposite cone spray) into fuel rail.
3. Rotate fuel injectors, so that the electrical connectors are on the outboard side. Push cone spray end of fuel injectors into bores of induction module until slot at bottom of fuel rail engages machined tab at top of induction module.
4. Install **new** O-ring and sealing washer in fuel rail bore. Install second O-ring and second sealing washer.
5. Push fuel supply tube into fuel rail bore.
6. Rotate fuel supply tube in a clockwise direction until tapered end of quick connect fitting is pointing upward. Now rotate tube an additional 90°, so that fitting is pointing rearward (toward TCA on induction module).
7. Engage slot on fuel supply tube clamp in groove of fuel supply tube fitting. Rotate fuel supply tube clamp 90° in a

counter-clockwise direction until curled lip on fuel supply tube clamp engages flange on fuel rail.

8. Align thru holes in fuel rail and fuel supply tube clamp with threaded hole in induction module. Install T25 TORX screw and tighten to 66-82 **in-lbs** (7.5-9.3 Nm).
9. Install induction module. 4.13 INDUCTION MODULE.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FUEL PUMP 4.17

GENERAL

⚠WARNING

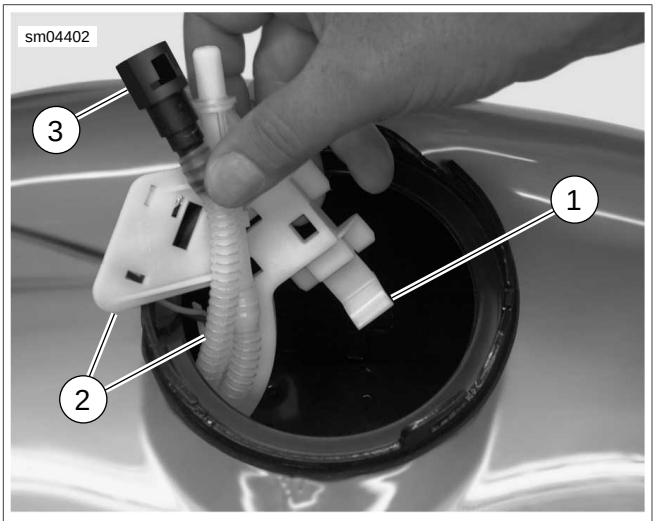
When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00330a)

Carefully inspect tubes for cuts, tears, holes or other damage. Replace fuel pump if any damage is found. Even a small hole can cause a reduction in fuel pressure.

Refer to the electrical diagnostic manual for information on the function and testing of the fuel pump.

REMOVAL

1. Remove top plate. See 4.6 FUEL TANK TOP PLATE.
2. Remove fuel level sender. See 4.9 FUEL LEVEL SENDER.
3. Pull up on transfer tube bracket to release two tabs at bottom from slots at top of fuel pump bracket.
4. Depress collar on each side of fitting to disconnect transfer tube from transfer tube bracket.
5. See Figure 4-33. Pull up on rear finger and slide fuel pump bracket forward until four ears on bracket are free of catches at top of tunnel.
6. See Figure 4-34. Remove fuel pump from left side of fuel tank. For best results, rotate fuel pump assembly 90 degrees in a clockwise direction until transfer tube connection is pointing rearward, and then pull from fuel tank.
7. If necessary, further disassemble fuel pump assembly as follows:
 a. Reaching into fuel tank, release transfer tube from weld clip on right side of tunnel and remove from fuel tank.
 b. Depress arms on fuel inlet strainer and remove from slots in fuel pump housing.
 c. Inspect the condition of the fuel pump wiring. If the wiring needs to be replaced, see 4.17 FUEL PUMP, Fuel Pump and Fuel Level Sender Wire Harness.



1. Fuel pump bracket (rear finger)
2. Transfer tube/bracket
3. Fuel pump to fuel filter fitting

Figure 4-33. Rear Finger (Fuel Pump Bracket)

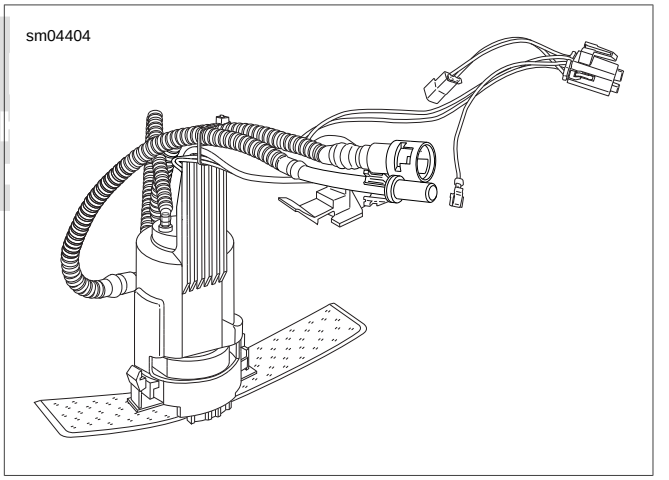


Figure 4-34. Fuel Pump Assembly

INSTALLATION

1. If removed, assemble fuel pump assembly as follows:
 a. Reaching into fuel tank, capture transfer tube in weld clip on right side of tunnel.
 b. Install fuel inlet strainer at bottom of fuel pump engaging arms in slots of fuel pump housing.
2. Install fuel pump into left side of fuel tank. For best results, hold fuel pump assembly, so that transfer tube connection is pointing rearward, and then insert into fuel tank. Now rotate assembly 90° in a counter-clockwise direction.
3. Look into fuel tank to verify that fuel inlet strainer lies flat and that ends are not folded under fuel pump. Also verify

that wire harness is still captured in molded clip at front of fuel pump bracket.

4. With the finger on the fuel pump bracket pointing rearward, engage four ears on bracket with rear set of catches at top of tunnel. Push fuel pump bracket rearward until ears are fully engaged.
5. Install transfer tube onto transfer tube bracket. Fit two tabs at bottom of transfer tube bracket into slots at top of fuel pump bracket. Verify that transfer tube is still captured in weld clip on right side of tunnel and that free end is in contact with bottom of fuel tank.
6. Install fuel level sender. See 4.9 FUEL LEVEL SENDER.
7. Install top plate. See 4.6 FUEL TANK TOP PLATE.

FUEL PUMP AND FUEL LEVEL SENDER WIRE HARNESS

Removal

NOTE

Damaged wiring, terminals and/or connectors requires replacement of the wire harness. Do not replace the special teflon coated wiring with ordinary bulk wire. Ordinary insulation materials may deteriorate when in contact with gasoline.

1. Remove fuel pump. See 4.17 FUEL PUMP.
2. Cut cable strap to release wire harness and both fuel pump and transfer tubes from arm of fuel pump bracket.
3. Release wire harness from molded clip at front of fuel pump bracket.
4. Remove connector at top of fuel pump.

Installation

1. Install connector at top of fuel pump.
2. Route wire harness rearward and then forward under arm of fuel pump bracket. Install **new** cable strap at elbow capturing fuel pump and transfer tubes at top of arm and wire harness at bottom. See Figure 4-35.
3. Route wire harness through molded clip at front of fuel pump bracket. See Figure 4-36.
4. Install fuel pump. See 4.17 FUEL PUMP.

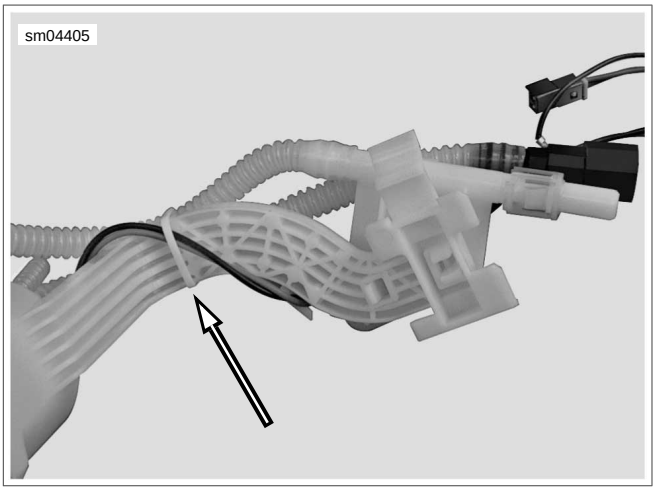


Figure 4-35. Cable Wires in Cable Strap

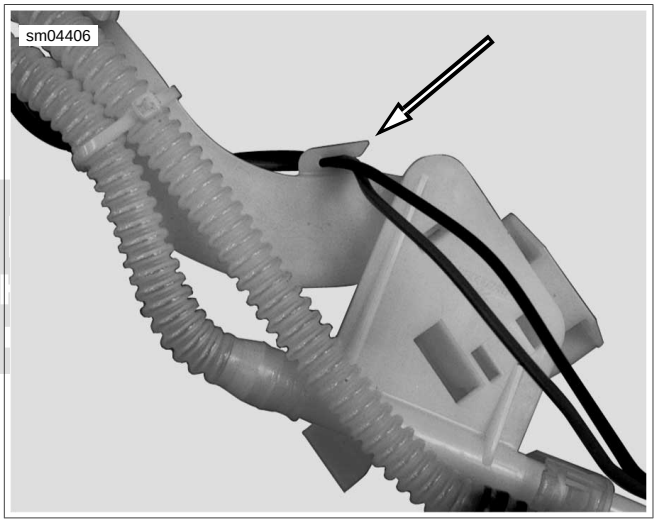


Figure 4-36. Capture Wires in Molded Clip

FUEL PRESSURE TEST 4.18

GENERAL

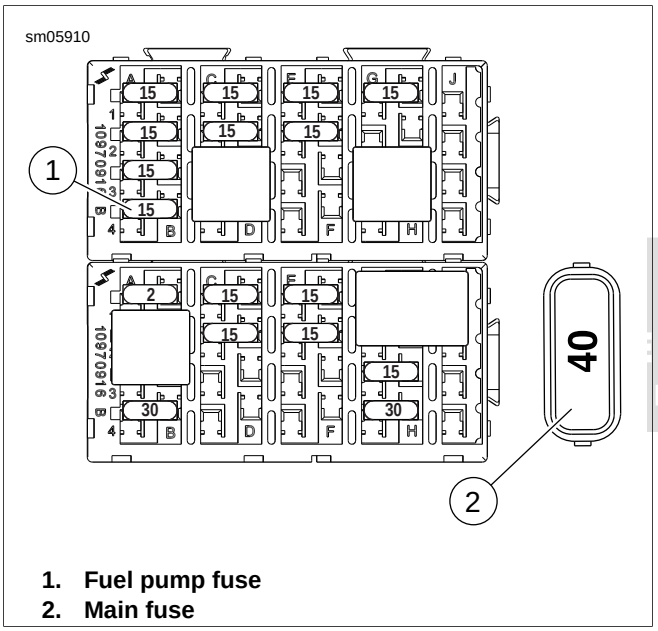
See Figure 4-37. The fuel pump fuse is located in the fuse block under the left side cover. The fuel pump can be turned on with Digital Technician or by applying battery voltage to the fuel pump fuse.

Improper fuel system pressure may contribute to one of the following conditions:

- Cranks, but won't run.
- Cuts out (may feel like ignition problem).
- Hesitation, loss of power or poor fuel economy.

NOTE

Refer to the electrical diagnostic manual for further information on the function and testing of the fuel system.



1. **Fuel pump fuse**
2. **Main fuse**

Figure 4-37. Fuse Blocks

TESTING

PART NUMBER	TOOL NAME
HD-41182	FUEL PRESSURE GAUGE
HD-44061	FUEL PRESSURE GAUGE ADAPTER

NOTE

Avoid kinking the fuel supply line when installing/removing the fuel pressure gauge and adapters.

⚠WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge and disconnect fuel supply line. See 4.5 FUEL TANK, Removal. Leave the fuel pump fuse removed.

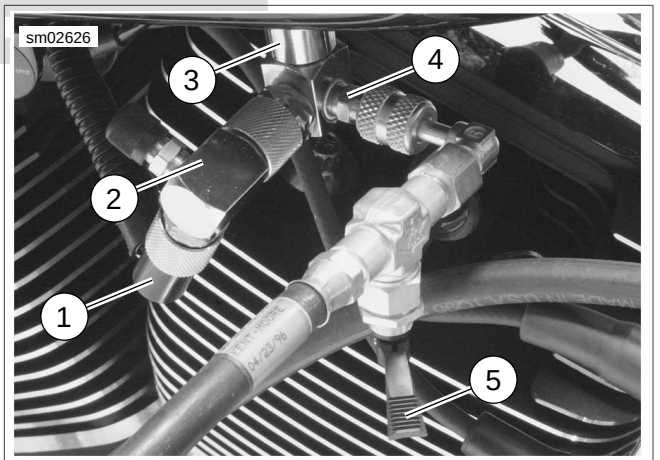
NOTE

Use two fuel pressure gauge adapters to prevent twisting of the fuel supply line. Tug on all connections to verify they are secure.

2. Install fuel pressure gauge adapters as follows:
 a. See Figure 4-38. Connect two FUEL PRESSURE GAUGE ADAPTER (Part No. HD-44061) together.
 b. Connect fuel line to adapter assembly.
 c. Connect adapter assembly to quick-connect fitting on fuel tank.



Figure 4-38. Fuel Pressure Gauge Adapters



1. **Fuel supply line**
2. **Adapter to fuel line**
3. **Adapter to fuel tank**
4. **Pressure adapter Schroeder valve union**
5. **Fuel valve (closed position)**

Figure 4-39. Fuel Line

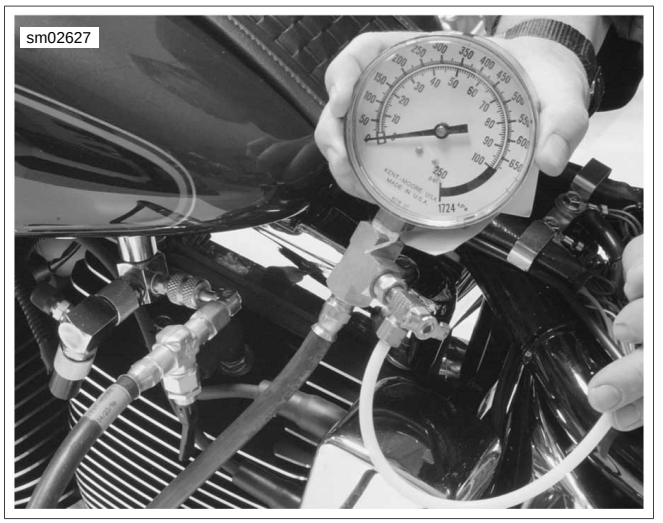


Figure 4-40. Fuel Pressure Gauge Installed (Typical)

⚠WARNING

To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)

3. Verify that the fuel valve and air bleed petcock on the FUEL PRESSURE GAUGE (Part No. HD-41182) are closed.
4. See Figure 4-39. Connect fuel pressure gauge to Schroeder valve closest to the fuel tank.
5. Install fuel pump fuse.
6. Start and idle engine to pressurize the fuel system. Open the fuel valve.
7. Position the clear air bleed tube in a suitable container and purge the gauge and hose of air. Close the petcock.
8. Vary the engine speed and note the reading of the pressure gauge. Fuel pressure should remain steady at 55-62 psi (380-425 kPa).

NOTE

If the fuel pressure is not within specification, see electrical diagnostic manual for further diagnosis.

⚠WARNING

Gasoline can drain from the fuel line and adapter when removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00255a)

9. Turn the engine off. Purge the fuel pressure gauge of gasoline and remove fuel pressure gauge from Schroeder valve. Install protective cap.
10. Remove adaptor fitting assembly from fuel supply line and quick-connect fitting on fuel tank.

⚠WARNING

To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)

11. Connect fuel supply line fitting to fuel tank quick-connect. Tug on fuel supply line fitting to verify that it is secure.
12. Install left side cover.
13. Install left side saddlebag. See 2.29 SADDLEBAGS.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

EXHAUST SYSTEM 4.19

MUFFLERS

Removal

1. Remove saddlebags. See 2.29 SADDLEBAGS.
2. See Figure 4-41. Remove two fasteners (2) and lock washers.
3. Loosen clamp (23).
4. Pull and twist muffler to remove. Repeat with other muffler.
5. Inspect rubber mount (1) for deterioration or damage. Replace as necessary.

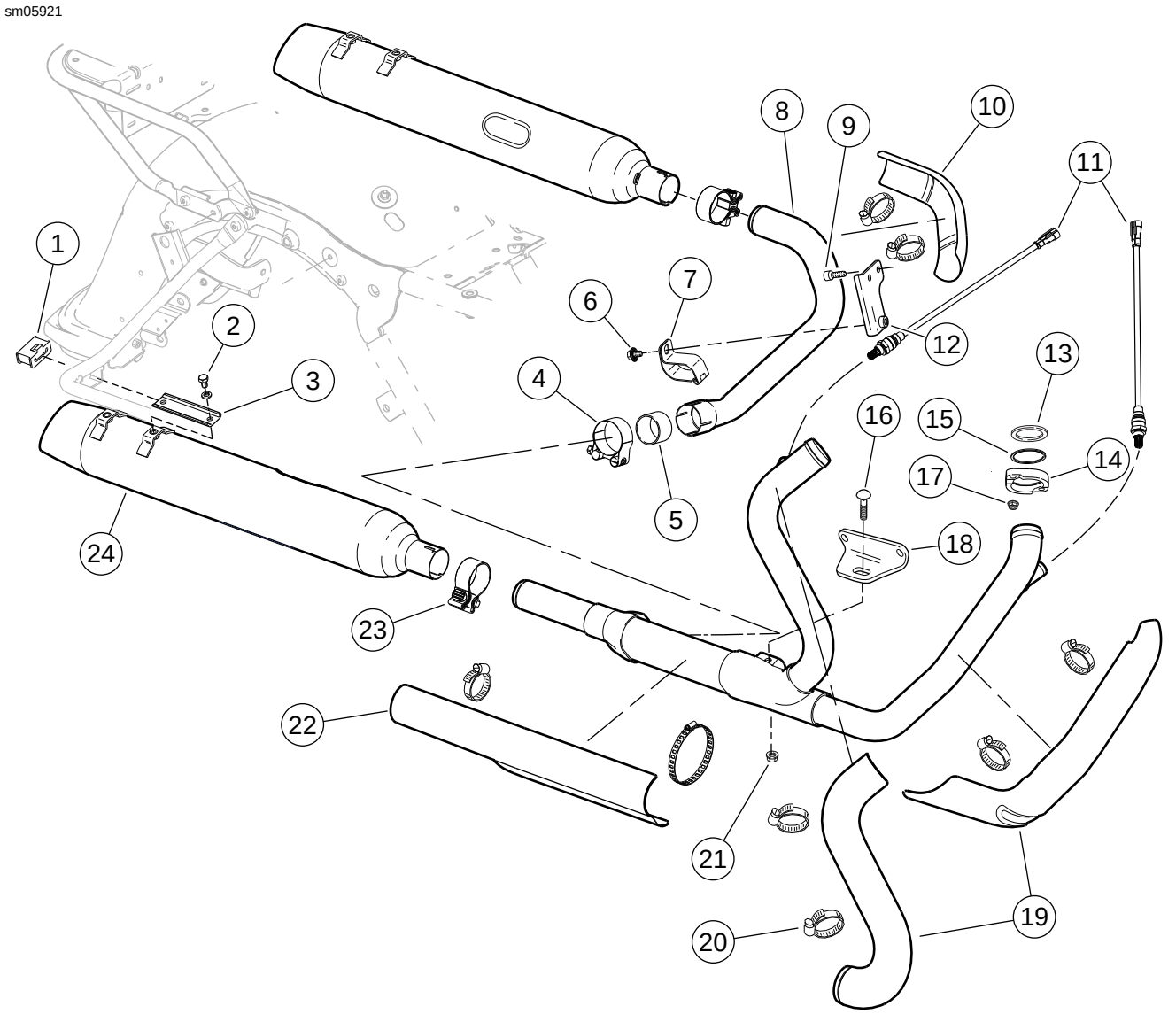
Installation

1. Slide **new** muffler clamp onto muffler. Push muffler squarely onto exhaust pipe.
2. Secure muffler to bracket (3) with fasteners (2) and lock-washers. Tighten fasteners to 96-144 **in-lbs** (10.8-16.3 Nm).
3. Position and tighten clamp (23) to 38-43 ft-lbs (51.5-58.3 Nm).
4. Install saddlebags. See 2.29 SADDLEBAGS.

SYSTEM REMOVAL

1. Remove saddlebags. See 2.29 SADDLEBAGS.
2. Remove mufflers. See 4.19 EXHAUST SYSTEM, Mufflers.
3. Remove seat. See 2.28 SEAT.
4. Remove right side front footboard and brackets from frame. See 2.52 FOOTBOARDS AND FOOTRESTS, Rider Footboards.
5. On HDI models, disconnect cable to exhaust valve actuator as follows:
 a. Locate active exhaust valve just forward of the right side muffler. Push cam rearward to remove tension from cable, and then release ball end from slot.
 b. Remove cable clip from slotted flange at front of active exhaust valve.
6. Disconnect front and rear O2 sensor connectors.
7. See Figure 4-41. Remove heat shields (10, 19, 22) from pipes.
8. Loosen clamp (4).
9. Remove fastener (6) and bracket (7).
10. Pull and twist on crossover pipe to remove (8).
11. Remove two flange nuts (17) to release front header pipe from studs of front cylinder head. Slide exhaust flange down header pipe to improve clearance around exhaust port.
12. Remove two flange nuts (17) to release rear header pipe from studs of rear cylinder head.
13. Remove flange nut (21) and carriage bolt (16).
14. Remove exhaust from motorcycle.
15. Remove and discard gaskets (13) from front and rear exhaust ports.
16. Inspect retaining rings (15) and flanges (14). Replace as necessary.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Rubber mount**
2. **Fastener (4)**
3. **Bracket (2)**
4. **Clamp**
5. **Gasket**
6. **Flange bolt**
7. **Exhaust support clamp**
8. **Crossover pipe**
9. **Fastener (2)**
10. **Heat shield, crossover pipe**
11. **O2 Sensor (2)**
12. **Transmission exhaust bracket**
13. **Gasket (2)**
14. **Exhaust flange (2)**
15. **Retaining ring (2)**
16. **Carriage bolt**
17. **Flange nut (4)**
18. **Exhaust bracket**
19. **Heat shields, header pipe, front**
20. **Worm clamps**
21. **Flange locknut**
22. **Heat shield, header pipe, rear**
23. **Muffler clamp (2)**
24. **Muffler (2)**

Figure 4-41. Exhaust System

SYSTEM INSTALLATION

1. If removed, install transmission exhaust bracket (12) and tighten fasteners (9) to 84-132 **in-lbs** (9.5-14.9 Nm).
2. Install **new** gaskets in both the front and rear cylinder head exhaust ports with the tapered side out.
3. Place exhaust header pipe into position on motorcycle and start two exhaust flange nuts to secure front header pipe to studs of front cylinder head.
4. See Figure 4-41. Roll pipe into position at rear cylinder, making sure welded bracket on header pipe is below the side exhaust bracket (18).

5. Start two exhaust flange nuts to secure rear header pipe to studs of rear cylinder head.
6. Secure header pipe to side exhaust bracket (18) with carriage bolt (16) and flange nut (21). Do not tighten at this time.
7. Slide **new** clamp (4) onto crossover pipe.
8. Install **new** gasket (5). Twist and push crossover pipe (8) onto exhaust header pipe.
9. Install exhaust support clamp (7) and secure with fastener (6). Do not tighten.
10. Install mufflers. See 4.19 EXHAUST SYSTEM, Mufflers.

NOTE

Verify that the exhaust pipes do not contact the motorcycle frame or any mounted components.

11. Tighten the exhaust system as follows:
 a. Tighten the top nut of the front cylinder head exhaust flange to 9-18 **in-lbs** (1-2 Nm). Tighten the bottom nut to 100-120 **in-lbs** (11.3-13.6 Nm). Final tighten the top nut to 100-120 **in-lbs** (11.3-13.6 Nm).
 b. Tighten the bottom nut of the rear cylinder head exhaust flange to 9-18 **in-lbs** (1-2 Nm). Tighten the top nut to 100-120 **in-lbs** (11.3-13.6 Nm). Final tighten the bottom nut to 100-120 **in-lbs** (11.3-13.6 Nm).
 c. Tighten flange locknut (21) to 20-25 ft-lbs (27.1-33.9 Nm).
 d. Tighten crossover pipe clamp (4) to 25-30 ft-lbs (33.9-40.7 Nm).
 e. Tighten fastener (6) to 14-18 ft-lbs (19.0-24.4 Nm).

NOTES

- *Verify that the heat shields do not contact the motorcycle frame or any mounted components.*
- *See Figure 4-42. Install crossover pipe heat shield with the longer straight portion toward the muffler.*

12. Install heat shields. Position each worm drive clamp so that screw is on the outboard side in the most accessible position and tighten to 20-40 **in-lbs** (2.3-4.5 Nm).
13. Connect O2 sensor connectors and install **new** cable straps to secure front connector to back of cross brace.
14. On HDI models, connect cable to exhaust valve actuator as follows:
 a. Install cable clip onto slotted flange at front of active exhaust valve.
 b. Push cam rearward and install ball end of cable into slot. Verify that cable is properly seated in channel of active exhaust valve.
15. Install right side front footboard and brackets. See 2.52 FOOTBOARDS AND FOOTRESTS, Rider Footboards.
16. Install seat. See 2.28 SEAT.
17. Install saddlebags. See 2.29 SADDLEBAGS.



Figure 4-42. Crossover Pipe Heat Shield

ACTIVE EXHAUST (HDI) 4.20

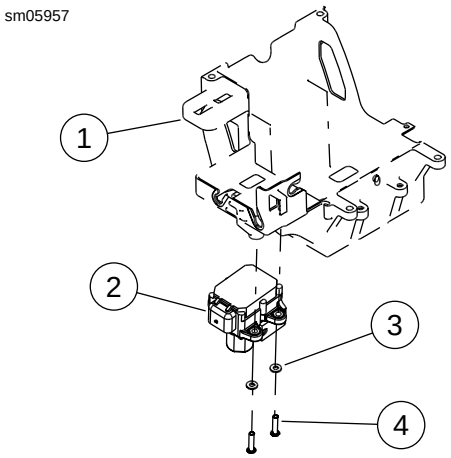
EXHAUST VALVE ACTUATOR

Removal

See Figure 4-43. Remove two fasteners (4) and washers (3) to release active exhaust valve actuator (2) from bottom of battery tray (1).

Installation

Install two fasteners to secure active exhaust valve actuator to bottom of battery tray. Tighten screws to 32-40 **in-lbs** (3.6-4.5 Nm).



1. **Battery tray**
2. **Actuator**
3. **Washer**
4. **Fastener**

Figure 4-43. Active Exhaust Actuator

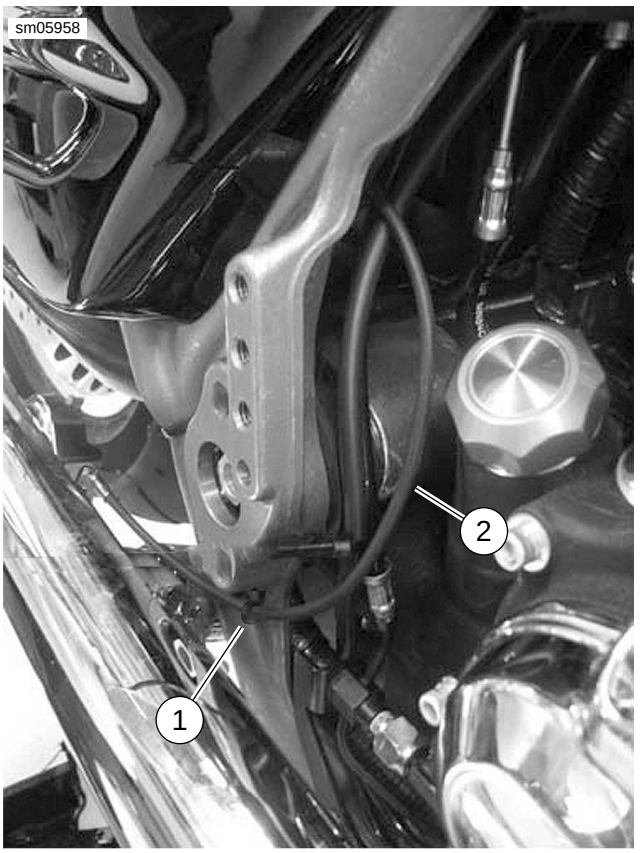
EXHAUST VALVE ACTUATOR CABLE

Removal

1. Remove exhaust valve actuator. See 4.20 ACTIVE EXHAUST (HDI), Exhaust Valve Actuator.
2. Remove cable as follows:
 a. Push on metal sleeve at end of cable housing to release plastic insert from slot in cable guide.
 b. Release cable from groove at center of actuator wheel and gently pull barrel end from hole.
3. See Figure 4-44.Release cable housing (2) from cable clip (1).

Installation

1. Install cable as follows:
 a. Gently push barrel end into hole in actuator wheel until cable engages groove at center.
 b. Push on metal sleeve at end of cable housing to engage plastic insert in slot of cable guide.
2. Install exhaust valve actuator. See 4.20 ACTIVE EXHAUST (HDI), Exhaust Valve Actuator.
3. See Figure 4-44. Secure cable housing (2) with cable clip (1).



1. **Cable clip**
2. **Cable housing**

Figure 4-44. Cable Routing

ACTIVE EXHAUST VALVE

General

The active exhaust valve is not repairable. Replace the rear exhaust header pipe if the valve is damaged or fails. See 4.19 EXHAUST SYSTEM.

INTAKE LEAK TEST 4.21

GENERAL

WARNING

Do not allow open flame or sparks near propane. Propane is extremely flammable, which could cause death or serious injury. (00521b)

WARNING

Read and follow warnings and directions on propane bottle. Failure to follow warnings and directions can result in death or serious injury. (00471b)

NOTES

- *To prevent false readings, keep air cleaner cover installed when performing test.*
- *Do not direct propane into air cleaner; false readings will result.*
- *Be careful when testing vehicle with Screamin' Eagle air cleaner assembly. This type of air cleaner has an open backing plate. Even with air cleaner cover on, directing nozzle too close to backing plate can give false readings.*

LEAK TESTER

PART NUMBER	TOOL NAME
HD-41417	PROPANE ENRICHMENT KIT

Parts List

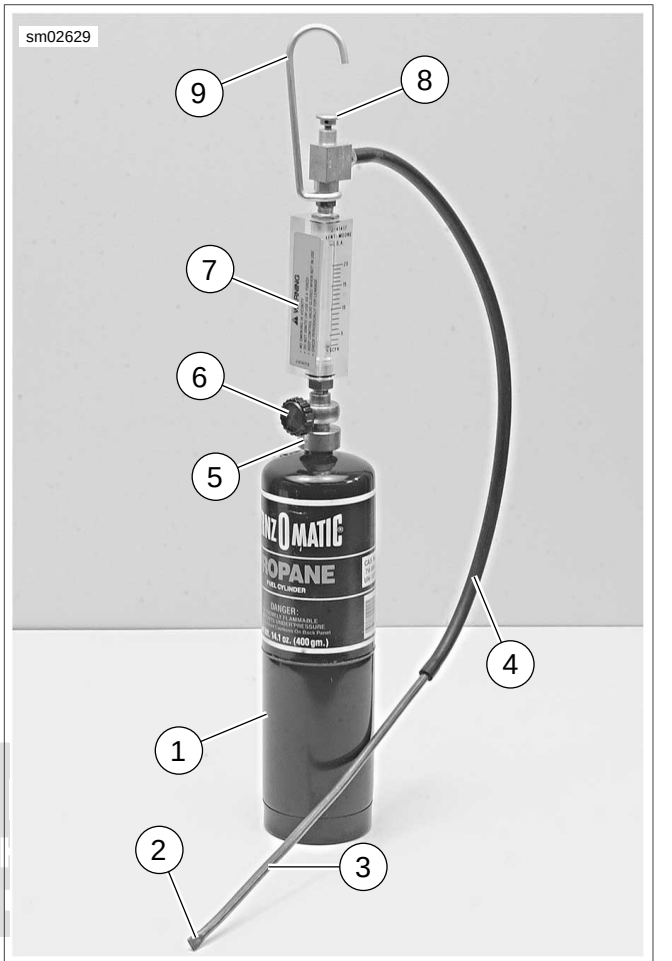
- Standard 14 oz. propane cylinder.
- PROPANE ENRICHMENT KIT (Part No. HD-41417).

Tester Assembly

1. See Figure 4-45. Make sure valve knob (6) is closed (fully clockwise).
2. Screw valve assembly (5) onto propane bottle (1).

Tester Adjustment

1. See Figure 4-45. Press and hold trigger button (8).
2. Slowly open valve knob (6) until pellet in flow gauge (7) rises to between 5 and 10 SCFH on gauge.
3. Release trigger button.



1. **Propane bottle**
2. **Nozzle**
3. **Copper tube**
4. **Hose**
5. **Valve assembly**
6. **Valve knob**
7. **Flow gauge**
8. **Trigger button**
9. **Hanger**

Figure 4-45. Leak Tester

PROCEDURE

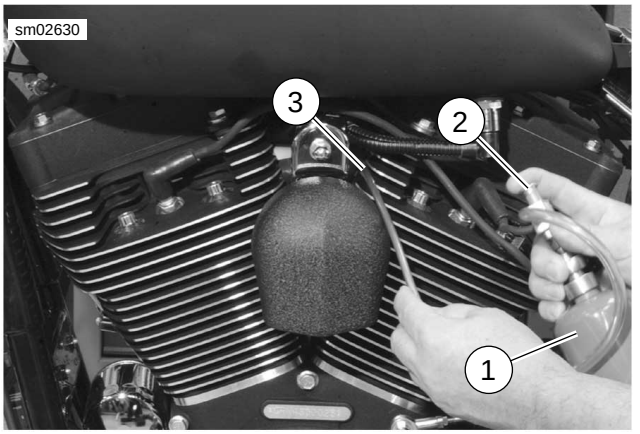
1. Start engine.
2. Warm up engine to operating temperature.

NOTE

Do not direct propane stream toward air cleaner. If propane enters air cleaner, a false reading will be obtained.

3. See Figure 4-46. Aim nozzle (3) toward possible sources of leak such as intake manifold mating surfaces.
4. Press and release trigger button (2) to dispense propane. Tone of engine will change when propane enters source of leak. Repeat as necessary to detect leak.

5. When test is finished, close valve knob (turn knob fully clockwise).



1. **Propane bottle**
2. **Trigger button**
3. **Nozzle**

Figure 4-46. Checking for Leaks

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

EVAPORATIVE EMISSIONS CONTROL (CA MODELS) 4.22

GENERAL

Motorcycles sold in some markets are equipped with an evaporative (EVAP) emissions control system. See Figure 4-47. The EVAP system functions as follows:

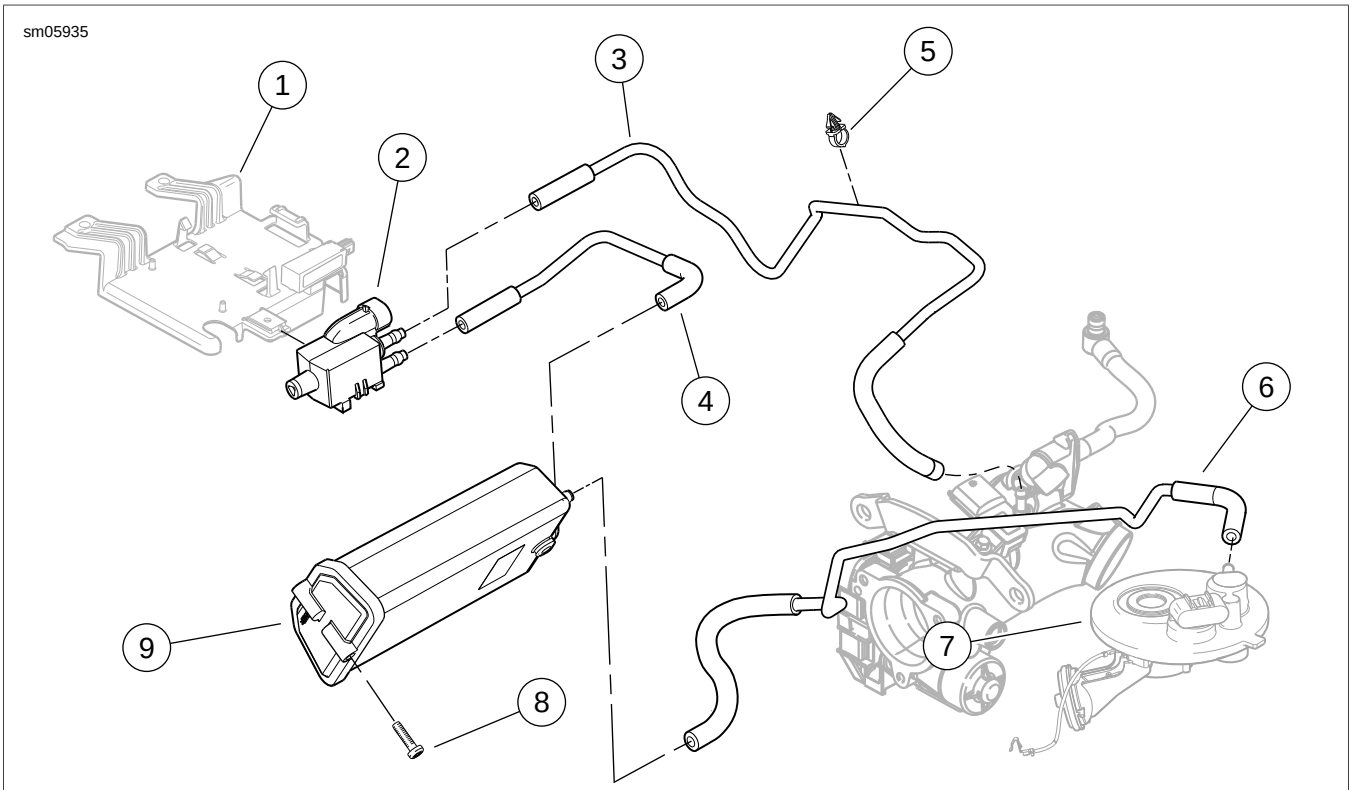
- The fuel vapor vent tube connected to the vapor valve on the fuel tank top plate allows fuel vapors in the fuel tank to be vented to the charcoal canister. If the motorcycle is tipped, the vapor valve also prevents the loss of gasoline through the vent tube.
- Under certain engine conditions, the ECM (working in conjunction with the EFI system relay) opens the purge solenoid. Negative pressure (vacuum) draws the fuel vapors stored in the charcoal canister through the purge tube to the induction module, where they are burned as part of the normal combustion process.

⚠WARNING

Keep evaporative emissions vent lines away from exhaust and engine. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00266a)

NOTE

The EVAP system has been designed to operate with a minimum of maintenance. Check that all tubes are correctly routed and properly connected. Also, verify that the tubes are not pinched or kinked, and that there is no contact with the engine parts.



1. **Top caddy**
2. **Purge solenoid**
3. **Canister-to-induction module tube**
4. **Canister-to solenoid tube**
5. **Cable clip**
6. **Fuel vapor vent tube**
7. **Fuel tank top plate**
8. **Fastener (2)**
9. **Charcoal canister**

Figure 4-47. Evaporative Emissions Control System (EVAP)

VAPOR VALVE

NOTE

See Figure 4-48. The vapor valve is not serviceable. Damage or failure of the vapor valve requires replacement of the fuel tank top plate. See 4.6 FUEL TANK TOP PLATE.

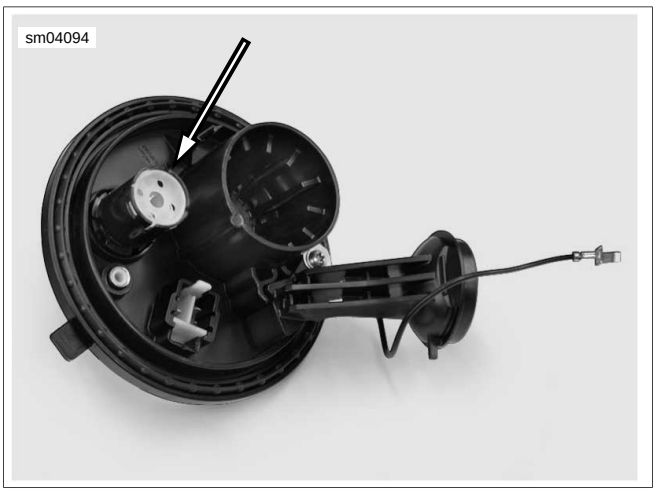


Figure 4-48. Fuel Tank Top Plate With Vapor Valve

FUEL VAPOR VENT TUBE

Removal

1. Remove seat. See 2.28 SEAT.
2. Remove fuel tank console:
 a. Remove screws to release front and rear of console from fuel tank.
 b. Lay a clean shop towel on forward part of rear fender.
 c. **FLHR/C:** Remove console and lay upside down on shop towel.
 d. **FLHX, FLHT/C/U, FLTR:** Remove filler cap. Remove console and lay upside down on shop towel. Install filler cap.
3. See Figure 4-47. Remove fuel vapor vent tube (6) from vapor valve fitting on fuel tank top plate (7).
4. Disconnect vent tube from fitting on canister (9).
5. Remove vapor vent tube from motorcycle.

Installation

1. See Figure 4-47. Connect fuel vapor vent tube (6) onto vapor valve fitting of fuel tank top plate (7).
2. Connect vent tube to fitting on charcoal canister (9) marked "TANK".
3. Install fuel tank console:
 a. **FLHR/C:** Position console on fuel tank.
 b. **FLHX, FLHT/C/U, FLTR:** Remove filler cap and position console on fuel tank. Install filler cap.
 c. Verify harnesses and vent tube are not pinched.
 d. Install screws to fasten front and rear of console to fuel tank.
 e. Tighten screws to 36-60 **in-lbs** (4.1-6.8 Nm).
4. Install seat. See 2.28 SEAT.

CANISTER-TO-SOLENOID TUBE

Removal

1. Remove seat. See 2.28 SEAT.
2. See Figure 4-49. Remove purge tube (2) from fitting of purge solenoid and canister.

Installation

1. Install end of purge tube with curved hose onto lower fitting of canister.
2. Install opposite end onto purge solenoid.
3. Install seat. See 2.28 SEAT.

SOLENOID-TO-INDUCTION MODULE TUBE

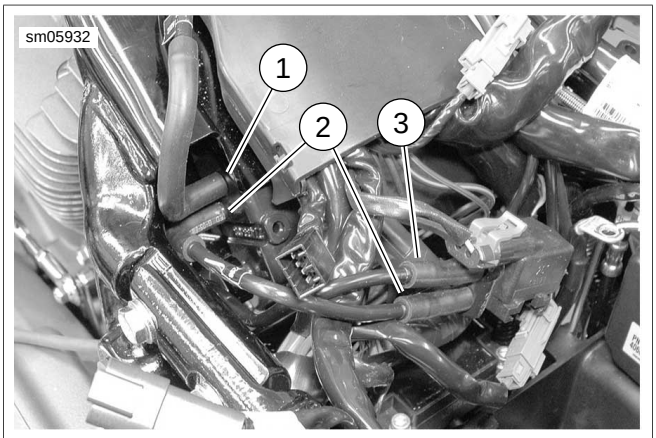
Removal

1. Remove seat. See 2.28 SEAT.
2. Remove fuel tank. See 4.5 FUEL TANK.
3. See Figure 4-49. Remove purge tube (3) from purge solenoid.
4. Remove cable clip on purge tube from frame backbone.
5. Disconnect tube from fitting on induction module.
6. Remove purge tube from motorcycle.

Installation

1. Route purge tube rearward under frame crossmember and into area near purge solenoid, then along bottom of frame backbone toward induction module. Connect to fitting on induction module.
2. See Figure 4-49. Route purge tube under frame crossmember and install on upper fitting (3) of purge solenoid.
3. Secure purge tube to bottom of frame backbone with **new** retainer.
4. Install fuel tank. See 4.5 FUEL TANK.
5. Remove seat. See 2.28 SEAT.

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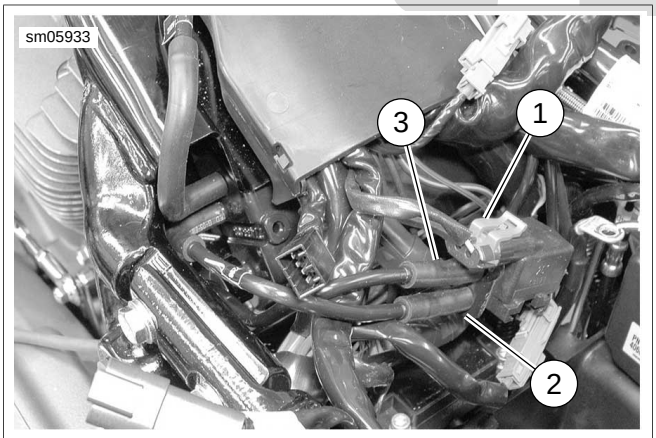
1. **Fuel vapor vent tube**
2. **Canister-to-solenoid purge tube**
3. **Solenoid-to-induction module purge tube**

Figure 4-49. Purge Tube Connections

PURGE SOLENOID

Removal

1. Remove seat. See 2.28 SEAT.
2. Remove top electrical caddy and remove purge solenoid from caddy. Lay caddy aside. See 7.7 ELECTRICAL CADDIES.
3. See Figure 4-50. Remove purge solenoid connector (1).
4. Remove purge tubes (2, 3) from purge solenoid.
5. Remove purge solenoid from motorcycle.



1. **Purge solenoid connector**
2. **Canister-to-solenoid purge tube**
3. **Solenoid-to-induction module purge tube**

Figure 4-50. Purge Solenoid

Installation

1. See Figure 4-50. Install purge tube to induction module (3) onto fitting of purge solenoid closest to the connector cavity.
2. Install purge tube from charcoal canister (2) onto purge solenoid.
3. Install purge solenoid connector (1).
4. Secure solenoid to top caddy and install top caddy. See 7.7 ELECTRICAL CADDIES.
5. Check all routing to be sure that tubes are not pinched or kinked, and that there is no contact with hot exhaust or engine parts.
6. Install seat. See 2.28 SEAT.

CHARCOAL CANISTER

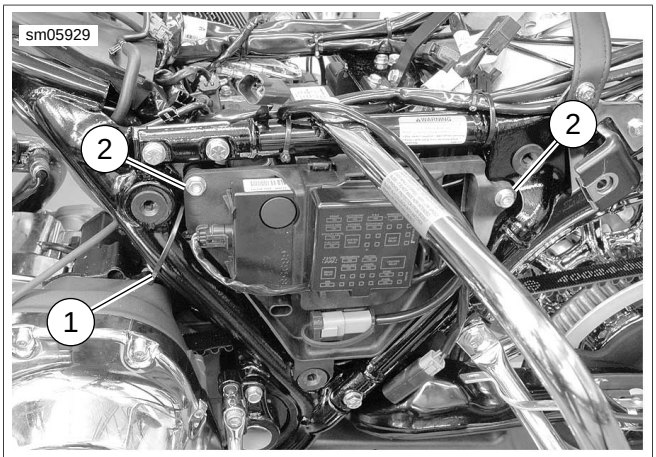
Removal

1. Remove seat. See 2.28 SEAT.
2. Remove saddlebags. See 2.29 SADDLEBAGS.
3. Remove side covers.
4. Remove battery. See 1.17 BATTERY MAINTENANCE.
5. Remove two fasteners to free top caddy hold-down bracket.
6. See Figure 4-51. Remove cable strap (1) securing main harness to frame near left side caddy.
7. Remove screws (2) securing left side caddy to frame.
8. See Figure 4-52. Disconnect fuel vapor vent tube (1) from canister fitting marked "TANK."
9. Disconnect purge tube (2) from canister fitting marked "PURGE."
10. See Figure 4-53. Remove three ground ring terminals from left ground stud (1).
11. Remove two ground ring terminals from right ground stud (2).
12. Remove two screws to release charcoal canister from frame cross member.
13. Work canister down into battery tray, right end first, and remove from motorcycle.

Installation

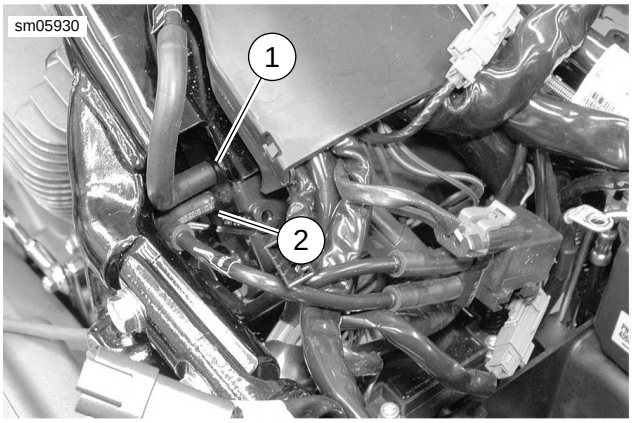
1. Slide the charcoal canister under electrical harnesses, fitting end first, and work into place.
2. Secure canister with two screws and tighten to 10-15 **in-lbs** (1.1-1.7 Nm).
3. See Figure 4-53. Install three ground ring terminals on left-side ground stud (1).
4. Install two ground ring terminals on right-side ground stud (2). Battery chassis ground terminal should be placed on stud first.
5. See Figure 4-52. Connect purge tube (2) (charcoal canister to purge solenoid) to lower canister fitting marked "PURGE."
6. Connect fuel vapor vent tube (1) (vapor valve to charcoal canister) to upper canister fitting marked "TANK."
7. See Figure 4-51. Install left side caddy and tighten two screws (2) to 72-96 **in-lbs** (8.1-10.9 Nm).
8. Secure main harness to frame with cable strap (1).

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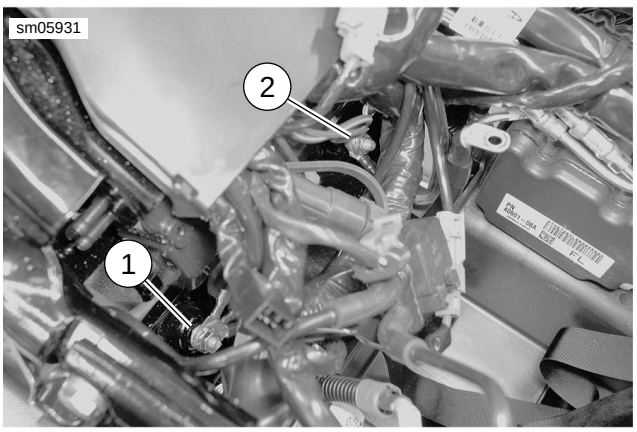
1. Cable strap
2. Fasteners

Figure 4-51. Left Electrical Caddy



1. Fuel vapor vent tube
2. Purge tube

Figure 4-52. Purge Tube Connections



1. Left ground stud
2. Right ground stud

Figure 4-53. Chassis Ground Studs

9. Check all routing to be sure that tubes are not pinched or kinked, and that there is no contact with hot exhaust or engine parts.
10. Install top caddy hold-down bracket. Tighten two fasteners to 32-40 **in-lbs** (3.6-4.5 Nm) .
11. Install battery. See 1.17 BATTERY MAINTENANCE.
12. Install side covers.
13. Install saddlebags. See 2.29 SADDLEBAGS.
14. Install seat. See 2.28 SEAT.

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NOTES

FASTENER TORQUE VALUES 5.1

FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

FASTENER	TORQUE VALUE		NOTES
Chain tensioner fasteners	15-19 ft-lbs	20.3-25.8 Nm	5.4 DRIVE COMPONENTS, Installation
Clutch diaphragm spring retainer bolts	90-110 **in-lbs**	10.2-12.4 Nm	5.6 CLUTCH, Clutch Pack Only
Clutch hub mainshaft nut	70-80 ft-lbs	94.9-108.5 Nm	5.4 DRIVE COMPONENTS, Installation
Compensating sprocket bolt	100 ft-lbs	135.7 Nm	5.4 DRIVE COMPONENTS, Installation/Initial torque then back off one turn.
Compensating sprocket bolt	140 ft-lbs	190.0 Nm	5.4 DRIVE COMPONENTS, Installation/Final torque
Diaphragm spring retainer bolts	90-110 **in-lbs**	10.2-12.4 Nm	5.6 CLUTCH, Clutch Pack and Bearing
Primary cover fasteners	108-120 **in-lbs**	12.2-13.6 Nm	5.3 PRIMARY CHAINCASE COVER, Installation/See sequence in the procedure
Sealing fasteners	25-27 ft-lbs	33.9-36.6 Nm	5.5 PRIMARY CHAINCASE HOUSING, Installation
Shift lever fasteners	18-22 ft-lbs	24-30 Nm	5.3 PRIMARY CHAINCASE COVER, Installation
Shift lever shaft fastener	90-110 **in-lbs**	10.2-12.4	5.3 PRIMARY CHAINCASE COVER, Installation
Transmission lockplate screws	84-132 **in-lbs**	9.5-14.9 Nm	5.7 TRANSMISSION SPROCKET, Installation/LOCTITE patch, use 3-5 times
Transmission sprocket nut	100 ft-lbs	136.0 Nm	5.7 TRANSMISSION SPROCKET, Installation/Right hand threads, initial torque only, apply several drops of LOCTITE THREADLOCKER 271 (red) to last few threads.
Transmission sprocket nut	35 ft-lbs	47.5 Nm	5.7 TRANSMISSION SPROCKET, Installation/Plus an additional 35-45 degrees final torque

DTC TECHNICIAN HARLEY-DAVIDSON

SPECIFICATIONS: DRIVE 5.2

SPECIFICATIONS

Table 5-1. Sprocket Teeth: 2009 Touring Models

DRIVE	ITEM	NUMBER OF TEETH
Primary	Engine	34
	Clutch	46
Final	Transmission	32
	Rear wheel	68

Table 5-2. Clutch Specifications

CLUTCH	DESCRIPTION
Type	Wet-multiple disc
Clutch lever freeplay (after internal adjustment)	1/16-1/8 in. (1.6-3.2 mm)

Table 5-3. Gear Ratios: 2009 Touring Models

GEAR	RATIO
1st Gear	9.593
2nd Gear	6.650
3rd Gear	4.938
4th Gear	4.000
5th Gear	3.407
6th Gear	2.875

NOTE

Overall gear ratios indicate number of engine revolutions required to drive rear wheel one revolution.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

PRIMARY CHAINCASE COVER 5.3

GENERAL

The primary chaincase is a sealed housing containing the primary chain, chain tensioner, clutch, engine compensating sprocket and alternator.

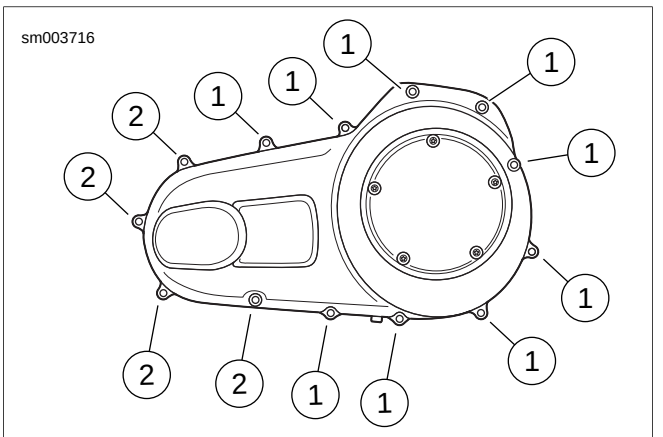
For information on primary chain lubrication, see 1.7 PRIMARY CHAIN.

REMOVAL

⚠WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.
2. Drain the primary chaincase lubricant. See 1.7 PRIMARY CHAIN, Chaincase Lubricant.
3. Remove left passenger footboard from rear fork bracket.
4. Remove fastener to release front footboard forward bracket from frame weldment. Remove two fasteners to free jiffy stand and front footboard rear bracket from frame weldment as an assembly.
5. Remove heel and toe shift lever fasteners from shift lever shaft and pull shift levers from shift lever shaft. Remove rubber spacer. An alternate method is to remove socket head fastener to release inner shift arm then pull shift lever shaft and heel toe shift lever assembly from primary chaincase bore.
6. See Figure 5-1. Remove nine short (1) and four long (2) cover fasteners and cover.



1. **Short cover fasteners**
2. **Long cover fasteners**

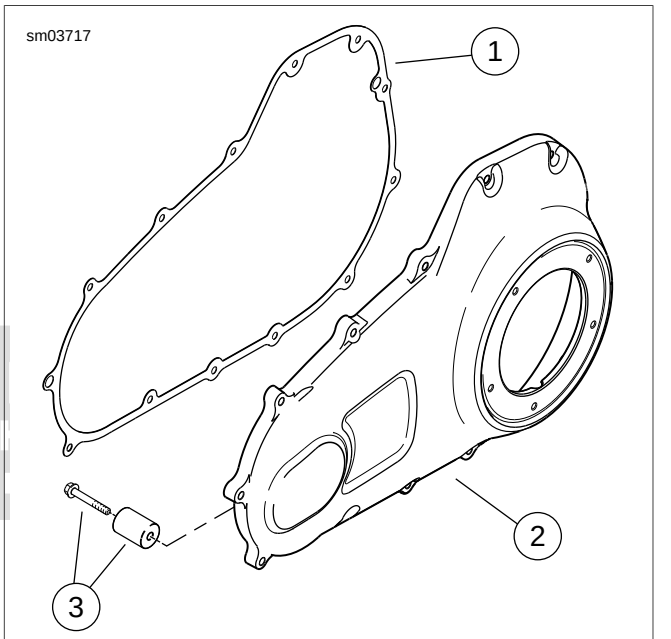
Figure 5-1. Primary Chaincase Cover: Touring Models

INSTALLATION

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

1. See Figure 5-2. Install **new** cover gasket (1).
2. See Figure 5-1. Install nine short (1) and four long (2) primary cover fasteners in positions shown. Snug fasteners.
3. See Figure 5-3. Tighten primary cover fasteners to 108-120 **in-lbs** (12.2-13.6 Nm) in the sequence shown.



1. **Cover gasket**
2. **Primary chaincase cover**
3. **Mass dampener/screw (Japan only)**

Figure 5-2. Primary Chaincase Cover Gasket

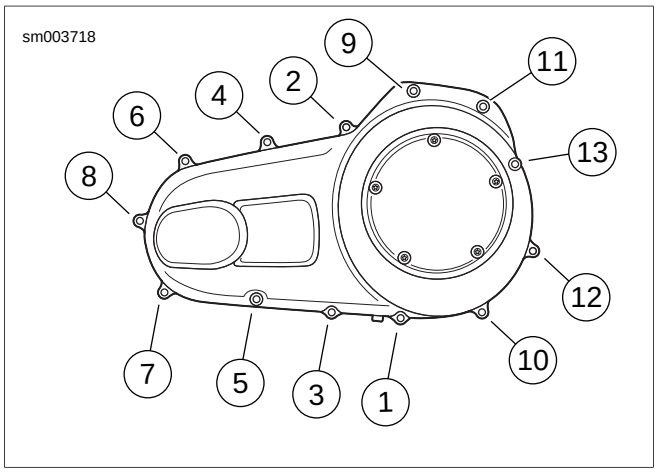


Figure 5-3. Primary Chaincase Cover Torque Sequence: Touring Models

CAUTION

Do not overfill the primary chaincase with lubricant. Overfilling can cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle. (00199b)

4. Place motorcycle in an upright position and fill primary chaincase. See 1.7 PRIMARY CHAIN, Chaincase Lubricant.

5. If installing heel-toe shift levers onto shift lever shaft:
 a. Install inboard shift lever (toe) onto splines of shift lever shaft. When properly installed, fastener hole is countersunk at the top.
 b. Install outboard shift lever (heel) onto splines of shift lever shaft. When properly installed, fastener hole is countersunk at the bottom.
 c. Install fasteners to fasten heel-toe shift levers to shift lever shaft. Tighten shift lever fasteners to 18-22 ft-lbs (24-30 Nm).

6. If just installing inner shift arm onto shift lever shaft:
 a. Install rubber spacer onto shift lever shaft. Install shift lever shaft into primary chaincase bore.
 b. Install inner shift arm onto splines of shift lever shaft.
 c. Install fastener to attach inner shift arm to shift lever shaft. Tighten fastener to 90-110 **in-lbs** (10.2-12.4).

7. Install jiffy stand and rider footboard. See 2.52 FOOTBOARDS AND FOOTRESTS.

8. Install passenger left footboard. See 2.52 FOOTBOARDS AND FOOTRESTS.

9. Connect negative battery cable.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

REMOVAL

PART NUMBER	TOOL NAME
HD-48219	PRIMARY DRIVE LOCKING TOOL

NOTES

To remove the primary chain, remove compensating sprocket, clutch assembly and primary chain as an assembly:

1. Disconnect the battery, negative cable first.
2. Remove primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Removal.
3. See Figure 5-4. Secure chain tensioner with a cable tie as shown. Make sure the tail of the cable tie hangs down past the primary housing when secured. This will serve as a reminder to remove the cable tie before installing the primary cover during assembly.
4. See Figure 5-5. Remove chain tensioner fasteners (2) and remove chain tensioner (1).

NOTE

Marking one of the outboard links of the primary chain to help identify the original direction of rotation during assembly may prolong service life.

5. Use a colored marker to mark one of the links of the primary chain to help identify the original direction of rotation during assembly.

WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

6. See Figure 5-6. Loosen locknut (3).
7. Remove retaining ring (1) and release plate (2).

WARNING

Do not apply heat to remove the clutch hub nut. Fuel vapor and possible fuel mixture in crankcase oil is extremely flammable and highly explosive, which could result in death or serious injury. (00440b)

NOTES

- *Use only PRIMARY DRIVE LOCKING TOOL (Part No. HD-48219) to remove and install components. Do not use PRIMARY DRIVE LOCKING TOOL (Part No. HD-41214) to remove or install components. Damage to components can occur if this tool is used.*
- *The mainshaft nut has left-hand threads. Turn clockwise to remove.*

8. See Figure 5-7. Install PRIMARY DRIVE LOCKING TOOL (Part No. HD-48219) (2) between the teeth of the engine and clutch sprockets as shown. Rotate clutch hub mainshaft nut (4) clockwise to remove.
9. See Figure 5-8. Install PRIMARY DRIVE LOCKING TOOL (Part No. HD-48219) (2) between the teeth of the engine and clutch sprockets as shown. Rotate compensating sprocket bolt (1) counterclockwise to remove.
10. See Figure 5-9. Remove bolt (6) and washer (5).
11. Remove clutch assembly, primary chain and compensating sprocket assembly as a single assembly.

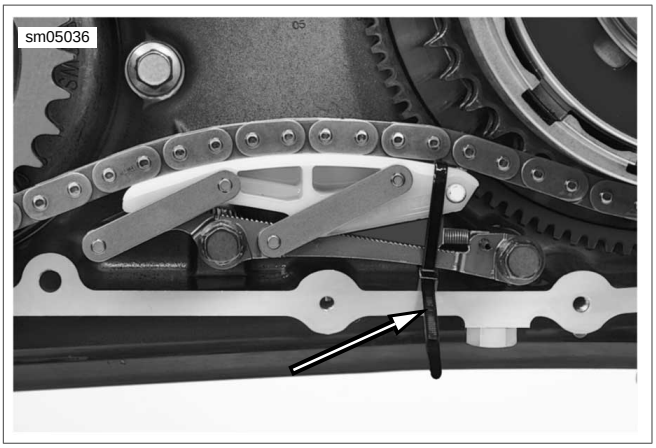
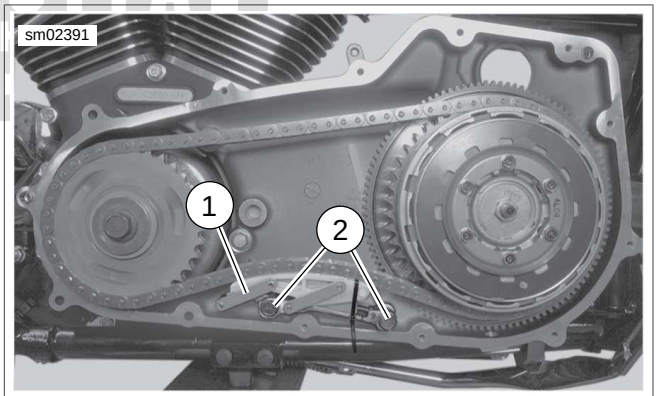
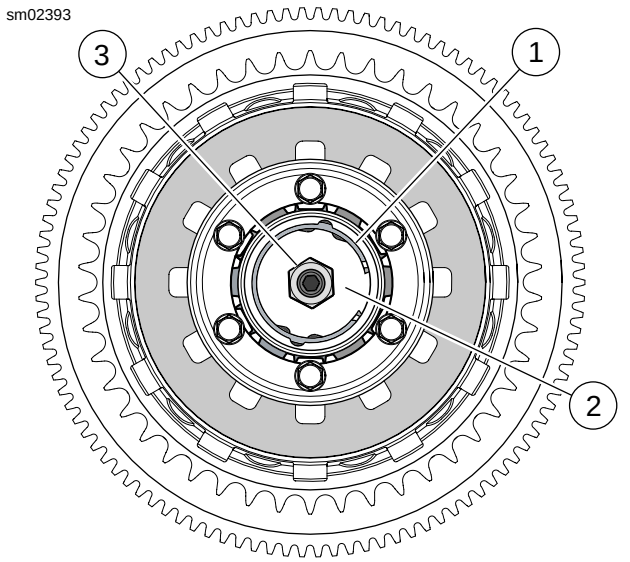


Figure 5-4. Securing Chain Tensioner



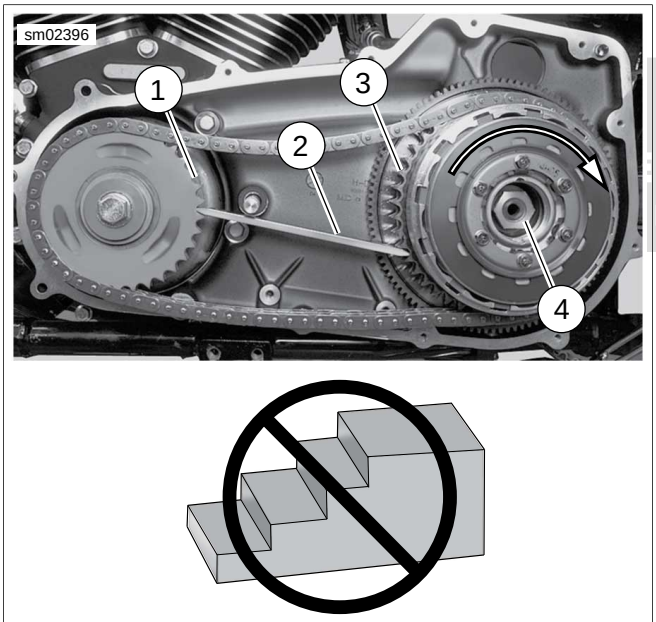
1. **Chain tensioner**
2. **Chain tensioner fasteners**

Figure 5-5. Chain Tensioner



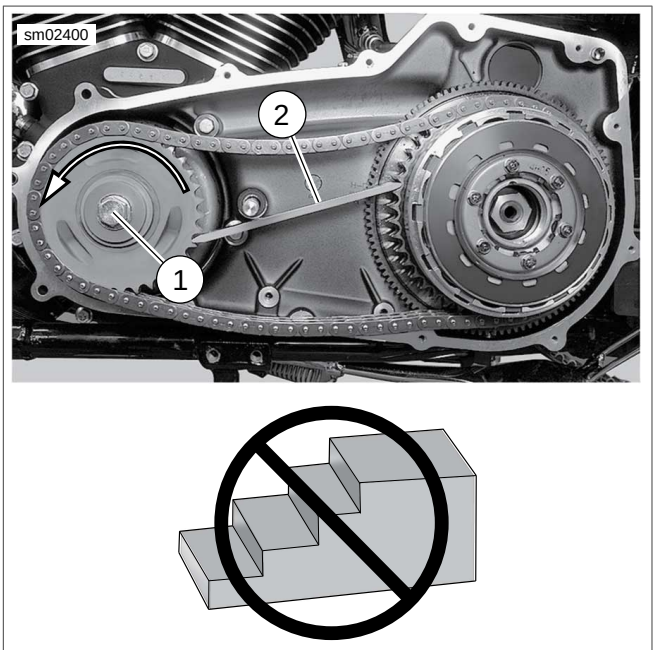
1. Retaining ring
2. Release plate
3. Locknut

Figure 5-6. Clutch



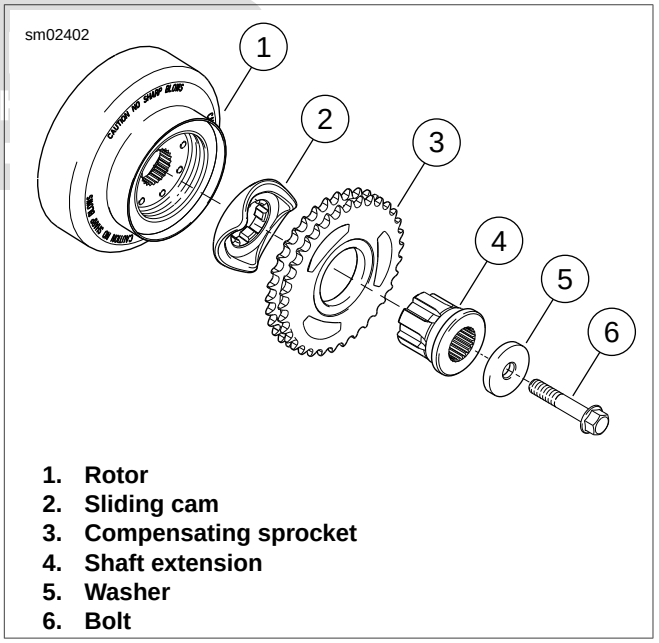
1. Engine sprocket
2. Primary drive locking tool
3. Clutch sprocket
4. Mainshaft nut

Figure 5-7. Removing Clutch Hub Mainshaft Nut



1. Bolt
2. Primary drive locking tool

Figure 5-8. Removing Compensating Sprocket Bolt



1. Rotor
2. Sliding cam
3. Compensating sprocket
4. Shaft extension
5. Washer
6. Bolt

Figure 5-9. Compensating Sprocket

INSTALLATION

PART NUMBER	TOOL NAME
HD-48219	PRIMARY DRIVE LOCKING TOOL

NOTE

The primary chain, compensating sprocket and clutch assembly must be installed as an assembly.

1. See Figure 5-9. Apply a thin layer of primary chaincase oil, to the inner diameter of the compensating sprocket (3) and the splines of shaft extension (4). Assemble shaft extension, compensating sprocket and sliding cam (2). Place primary chain over compensating sprocket assembly.
2. Place drive components (primary chain, compensating sprocket assembly, and clutch assembly) into position.
3. Clean all residual locking agent from the threads of the sprocket shaft and prime.
4. Install **new** compensating sprocket bolt (6). Install bolt and washer (5) hand tight.

NOTE

Clutch hub mainshaft nut has left-hand threads.

5. Clean and prime threads of mainshaft nut and apply two drops of LOCTITE THREADLOCKER 262 (red) to the threads. Start nut onto mainshaft and hand-tighten.

NOTE

The following step requires that PRIMARY DRIVE LOCKING TOOL (Part No. HD-48219) be reversed during the procedure.

6. See Figure 5-10. Install PRIMARY DRIVE LOCKING TOOL (Part No. HD-48219) as shown. Tighten compensating sprocket bolt as follows:
 a. Tighten bolt to 100 ft-lbs (135.7 Nm). Reverse the DRIVE LOCKING TOOL and loosen bolt one full turn.
 b. Again install the tool as shown in Figure 5-10 and tighten to final torque of 140 ft-lbs (190.0 Nm).
7. See Figure 5-11. Install PRIMARY DRIVE LOCKING TOOL (Part No. HD-48219) as shown. Tighten clutch hub mainshaft nut to 70-80 ft-lbs (94.9-108.5 Nm). Remove primary drive locking tool.
8. See Figure 5-12. Install release plate (5) with locknut (2) and adjuster screw (3) into clutch hub bore. The word "OUT" stamped on the release plate should face outward.

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

9. Inspect retaining ring (4) and replace if necessary. Install retaining ring in clutch hub bore to lock release plate in position. Verify that the retaining ring is completely seated in the groove.
10. Adjust clutch. See 1.11 CLUTCH, Adjustment.

NOTE

Primary chain tensioner is non-repairable. If tensioner is worn or damaged, assembly must be replaced.

11. See Figure 5-13. If primary chain tensioner becomes disassembled, assemble in order shown.
12. See Figure 5-14. Locate end of spring rod (2) on roll pin (3).
13. See Figure 5-15. Slide wedge (2) of primary chain tensioner in direction of arrow until all travel is removed. Hold shoe (1) and wedge (2) together.
14. See Figure 5-16. Insert cable tie (2) as shown to hold wedge in place. Make sure end of cable tie is located below primary chain tensioner to serve as a reminder to remove cable tie before installing primary cover.

NOTE

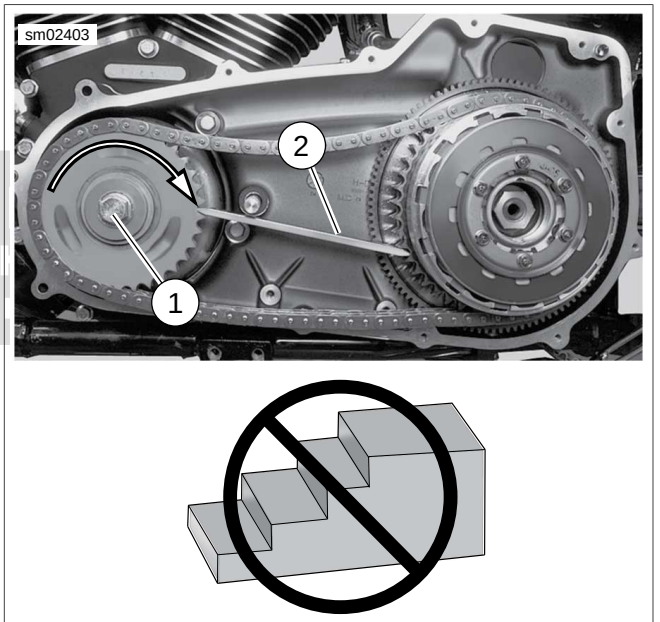
Primary chain tensioner will not complete chain adjustment until vehicle is ridden. Vehicle must be test ridden after tensioner removal/installation to verify proper adjustment.

15. See Figure 5-17. Install primary chain tensioner (1) and tighten fasteners (2) to 15-19 ft-lbs (20.3-25.8 Nm). Remove cable tie.

NOTE

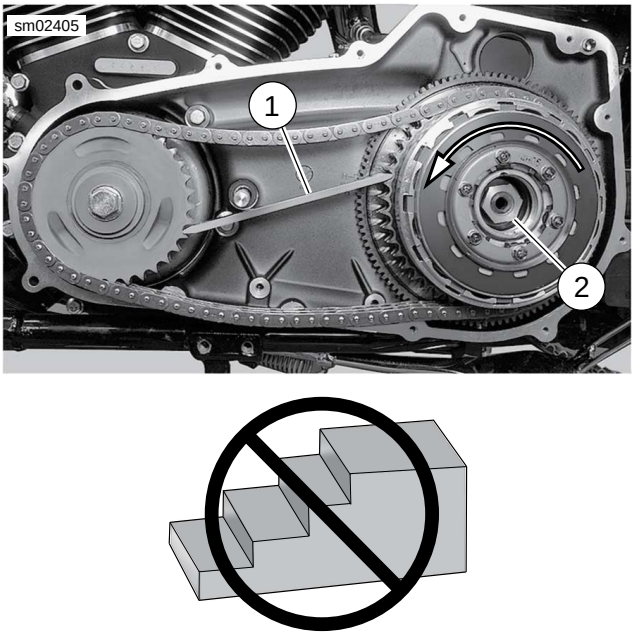
The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed to prevent primary chaincase leaks.

16. Install primary chaincase cover and fill with lubricant. See 5.3 PRIMARY CHAINCASE COVER, Installation.



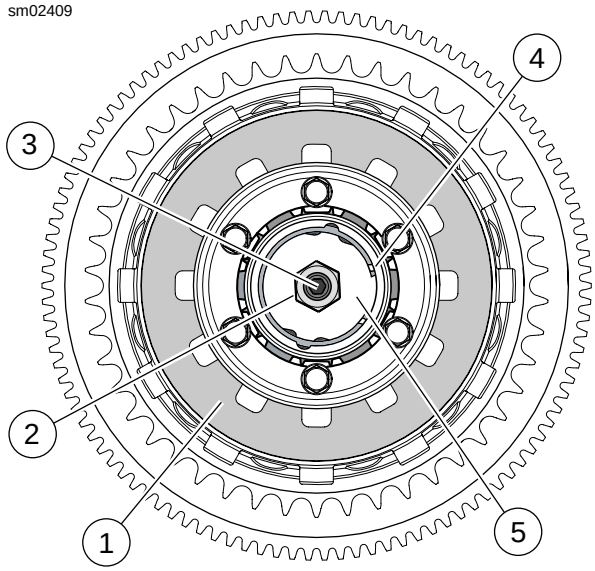
1. **Bolt**
2. **Primary drive locking tool**

Figure 5-10. Installing Compensating Sprocket Bolt



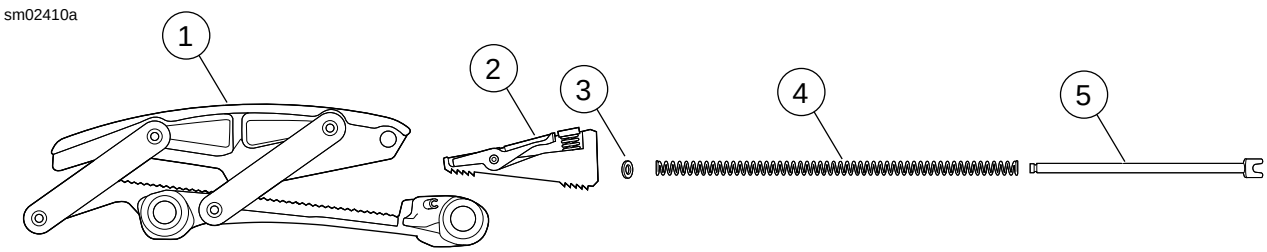
1. Primary drive locking tool
2. Mainshaft nut

Figure 5-11. Installing Clutch Hub Mainshaft Nut



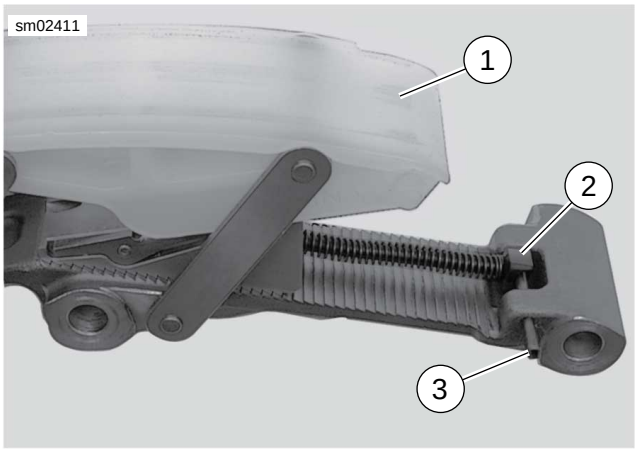
1. Diaphragm spring
2. Locknut
3. Adjuster screw
4. Retaining ring
5. Release plate

Figure 5-12. Clutch



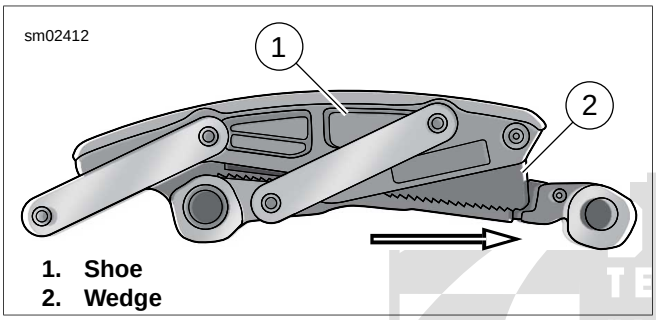
1. Shoe assembly
2. Wedge
3. Washer
4. Spring
5. Spring rod

Figure 5-13. Primary Chain Tensioner Assembly



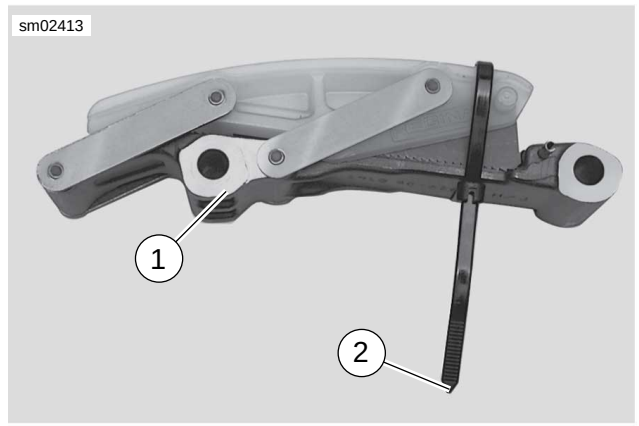
1. Shoe
2. Spring rod
3. Roll pin

Figure 5-14. Spring Rod Location



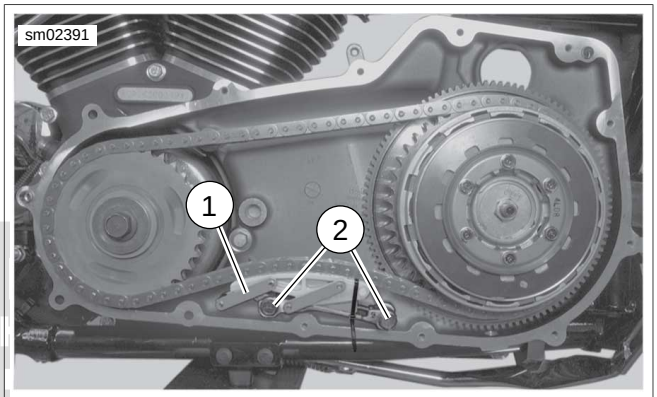
1. Shoe
2. Wedge

Figure 5-15. Primary Chain Tensioner



1. Primary chain tensioner
2. Cable tie

Figure 5-16. Securing Primary Chain Tensioner



1. Chain tensioner
2. Chain tensioner fasteners

Figure 5-17. Chain Tensioner

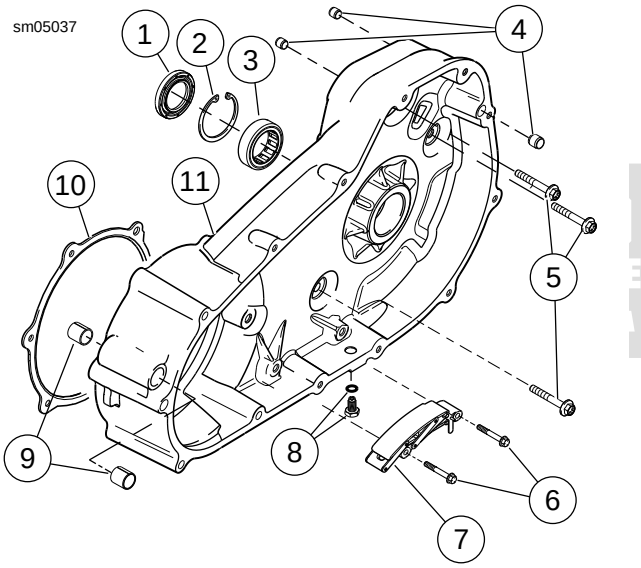
PRIMARY CHAINCASE HOUSING 5.5

REMOVAL

⚠WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.
2. Remove primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Removal.
3. Remove starter. See 7.9 STARTER, Removal.
4. Remove primary chain, clutch, and compensating sprocket. See 5.4 DRIVE COMPONENTS, Removal.
5. See Figure 5-18. Remove five sealing fasteners (5) and remove primary chaincase housing (10). Discard the crankcase gasket (12) and sealing fasteners.



1. **Seal**
2. **Lock ring**
3. **Bearing**
4. **Dowel pin**
5. **Sealing fastener (5)**
6. **Chain tensioner fasteners**
7. **Chain tensioner**
8. **Drain plug and o-ring**
9. **Shifter shaft bushings**
10. **Crankcase gasket**
11. **Primary chaincase housing**

Figure 5-18. Primary Chaincase Housing

INSPECTION

1. Inspect primary chaincase for cracks or damaged gasket surface.
2. Check the mainshaft bearing. Replace if bearing does not rotate freely. Replace the lip seal. See 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing and Lip Seal.
3. Inspect shifter shaft bushings. Replace if worn or damaged. See 5.5 PRIMARY CHAINCASE HOUSING, Shifter Shaft Bushings.

MAINSHAFT BEARING AND LIP SEAL

Removal

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

1. Remove lip seal from bearing bore on transmission side of primary chaincase. Use a seal remover or rolling head pry bar for best results.
2. Remove retaining ring from groove on transmission side of bearing.
3. Support inner primary chaincase on transmission side of bearing.

NOTE

Support inner primary chain case area on transmission side while pressing bearing out of primary chaincase. The force needed to remove bearing may cause damage to primary chain case.

4. Place primary chaincase in arbor press. Press out bearing from clutch side applying pressure to the outer race.

Installation

1. Inspect the bearing bore to verify that it is clean and smooth. Install retaining ring in groove on pulley side of primary chaincase.
2. Place primary chaincase in arbor press with the transmission side up.
3. Support the bearing support area on the clutch side of the primary chaincase.

NOTE

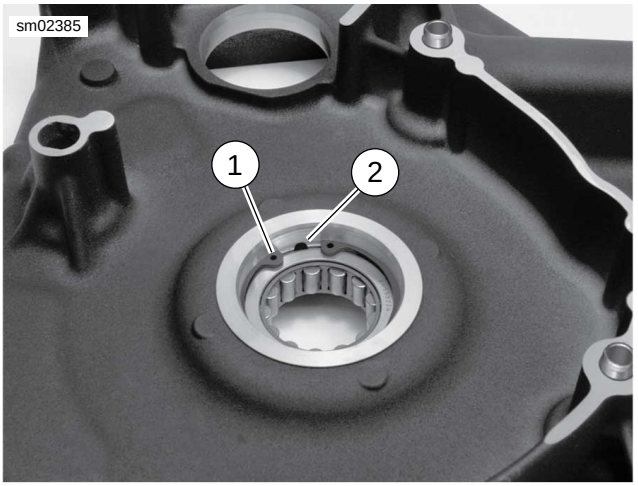
Support the bearing support area on clutch side while pressing bearing into bore. The force needed to press bearing into position may force and unsupported primary chain case to become damaged.

4. Apply a thin film of oil to outer diameter of bearing.
5. Applying pressure to the outer race, press **new** bearing letter side up, into bore until it makes solid contact with the bearing support area.
6. See Figure 5-19. Retaining ring (1) must be oriented as shown to prevent blocking of oil passage (2). Install retaining ring to lock position of bearing in bore. Verify that the ring is fully seated in the groove and is in proper orientation.

NOTES

- *The lip garter spring side of the oil seal is also identified by the words "OIL SIDE".*
- *Install oil seal with a seal driver that will press only against outer rim of oil seal, NOT against the inner area.*
- *The minimum allowable depth of the seal is reached when the outer edge of the seal carrier is flush with the machined surface of the primary housing. The maximum allowable depth of the seal is reached when the seal carrier contacts the mainshaft bearing snap ring.*

7. Install mainshaft oil seal:
 a. Lubricate the O.D. of the **new** seal with clean engine oil.
 b. See Figure 5-20. With the lip garter spring side (stamped "oil side") facing toward the bearing, press squarely on the outer edge of oil seal until outer edge of seal is flush with machined surface of inner primary housing.
8. Lubricate the bearing and seal lip with multi-purpose grease or clean engine oil.



1. **Retaining ring**
2. **Oil passage**

Figure 5-19. Retaining Ring Orientation

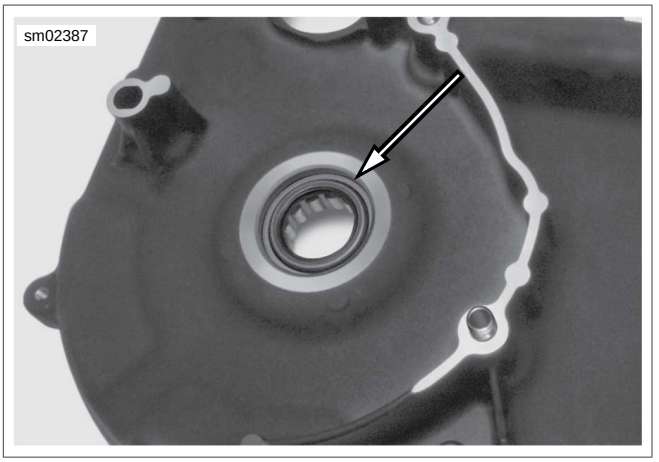


Figure 5-20. Oil Seal

MAINSHAFT BEARING INNER RACE

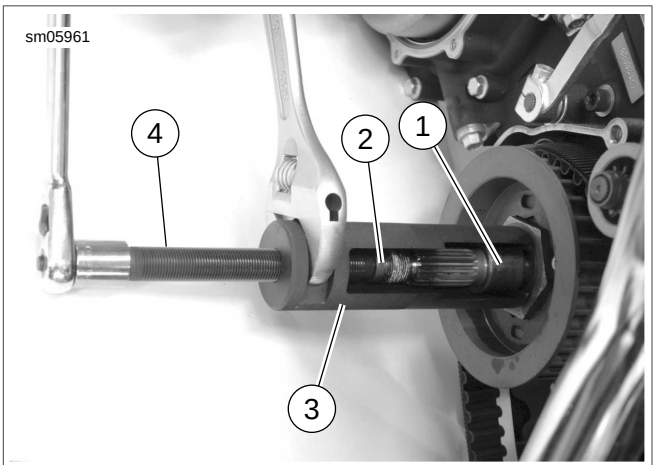
PART NUMBER	TOOL NAME
HD-34902-C	MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER

Removal

NOTE

The bearing inner race must be positioned on the shaft a precise distance to properly align with the bearing outer race in the primary chaincase. To remove and install the bearing inner race, use the combination MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER (Part No. HD-34902-C).

1. See Figure 5-21. Install end cap (2) into end of mainshaft.
2. Position puller (3) around mainshaft, under bearing inner race.
3. Turn forcing screw (4) clockwise while holding puller to remove bearing.



1. **Bearing inner race**
2. **End cap**
3. **Puller**
4. **Forcing screw**

Figure 5-21. Pulling Mainshaft Inner Bearing Race

Installation

1. See Figure 5-23. Slide bearing inner race (1), chamfered edge first, onto mainshaft.

NOTE

Extension shaft has left-hand threads.

2. Thread extension shaft (2) onto end of mainshaft .
3. Position installer sleeve (4) over extension shaft and against bearing inner race. Apply graphite lubricant to threads of extension shaft.
4. Place two washers (5) over threaded portion of extension shaft and install nut.
5. Tighten nut (6) while holding extension shaft stationary with wrench on flats (3) at end of screw threads. Press race onto shaft so inside edge is 0.100-0.125 in. (2.540-3.180 mm) from main drive gear.
6. Lubricate race with primary chaincase lubricant.

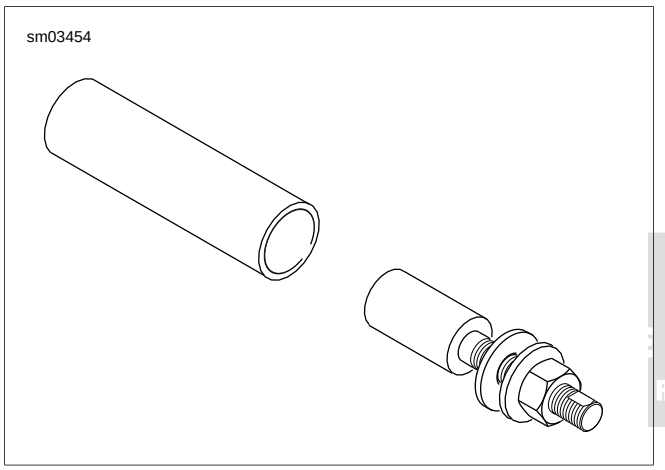
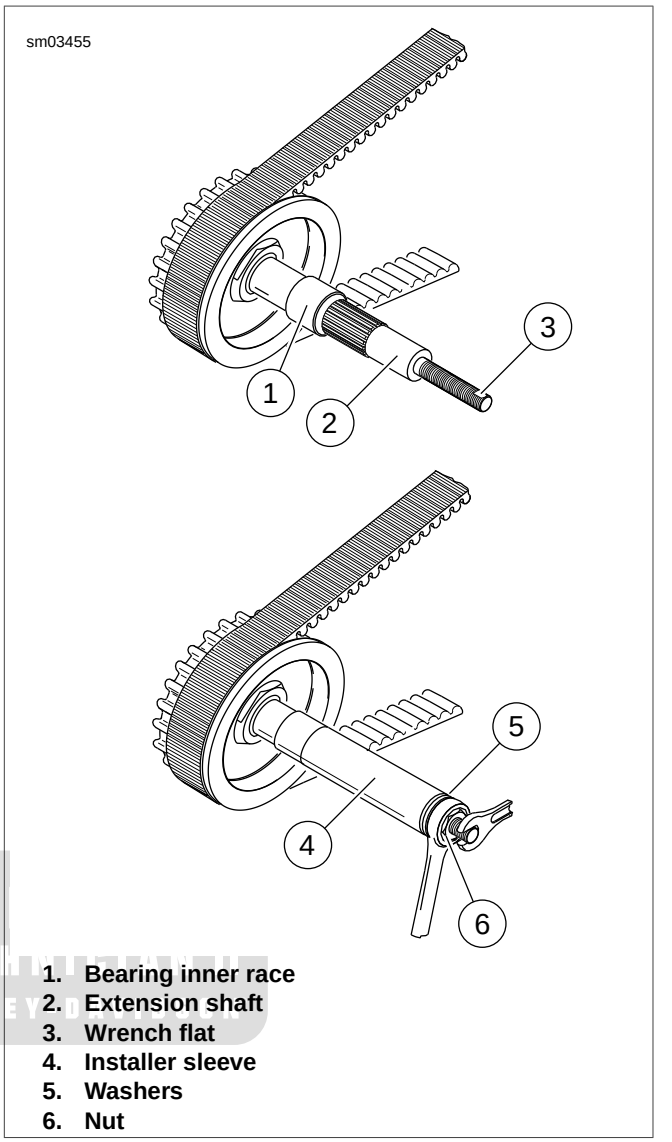


Figure 5-22. Mainshaft Bearing Inner Race Installer

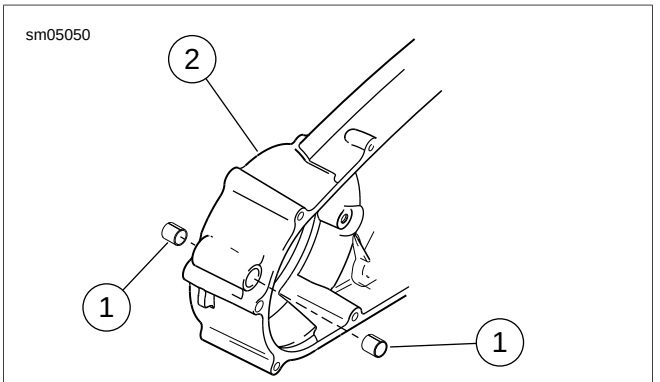


1. **Bearing inner race**
2. **Extension shaft**
3. **Wrench flat**
4. **Installer sleeve**
5. **Washers**
6. **Nut**

Figure 5-23. Installing Bearing Race

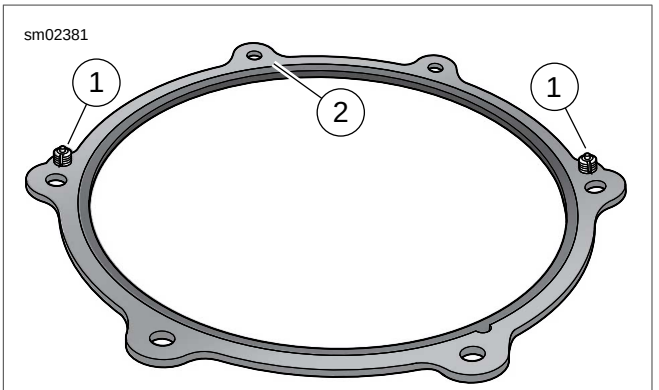
SHIFTER SHAFT BUSHINGS

1. See Figure 5-24. Press out old bushings (1) using an arbor press. Inspect the bushing bore to verify that it is clean and smooth.
2. Press **new** bushings into each side of the bore using an arbor press. Installed bushing must be flush to 0.010 in. (0.25 mm) below edge of bore.



1. **Shifter shaft bushing (2)**
2. **Primary chaincase**

Figure 5-24. Shifter Shaft Bushings



1. **Dowel**
2. **Crankcase gasket**

Figure 5-25. Crankcase Gasket

INSTALLATION

NOTE

Cover mainshaft clutch hub splines with tape to prevent the splines damaging the inner primary cover oil seal.

1. Verify pivot shaft torque. See 2.24 REAR FORK, Installation.

NOTE

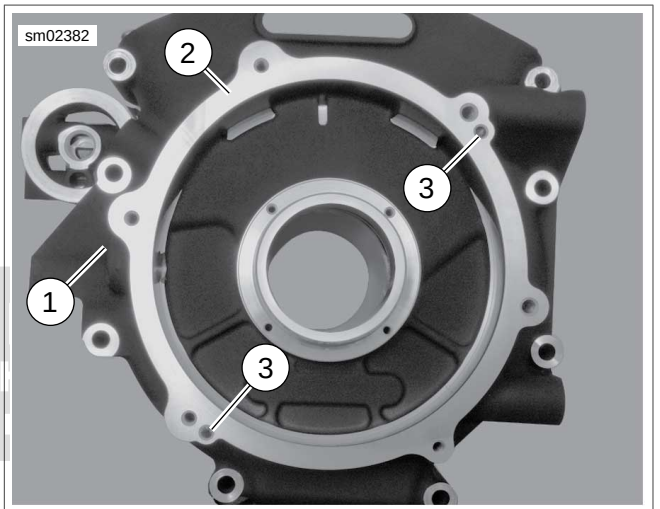
See Figure 5-25. In next step, be sure dowels (1) in crankcase gasket (2) engage holes in crankcase.

2. See Figure 5-26. Place crankcase gasket in place on gasket surface (2). Be sure dowels in gasket engage dowel holes (3).
3. Spread a thin film of oil on mainshaft oil seal lip and rubber portion of crankcase gasket. Be careful not to damage mainshaft seal when installing chaincase over the primary bearing inner race on the mainshaft.
4. See Figure 5-27. Insert **new** sealing fasteners.
5. See Figure 5-28. Tighten fasteners in sequence shown to 25-27 ft-lbs (33.9-36.6 Nm).
6. Install the primary chain, clutch, and compensating sprocket as an assembly. See 5.4 DRIVE COMPONENTS, Installation.
7. Install chain tensioner assembly.
8. Install starter. See 7.9 STARTER, Installation.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks .

9. Install primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Installation.
10. Fill primary chaincase with lubricant. See 1.7 PRIMARY CHAIN, Chaincase Lubricant.
11. Adjust rear belt tension.
12. Connect negative battery cable.



1. **Crankcase**
2. **Gasket surface**
3. **Dowel holes**

Figure 5-26. Crankcase

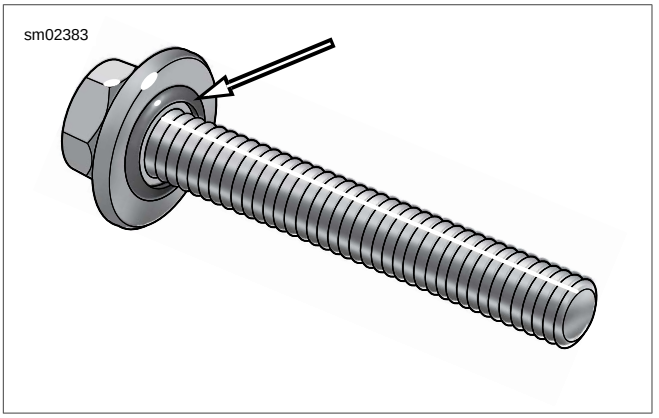


Figure 5-27. Sealing Fastener

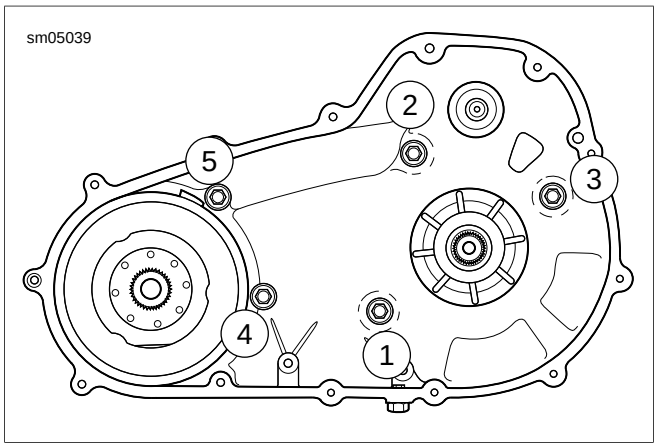


Figure 5-28. Sealing Fastener Torque Sequence

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

CLUTCH 5.6

REMOVAL AND INSTALLATION

To remove the clutch without disassembly or for installation instructions, see 5.4 DRIVE COMPONENTS, Removal.

CLUTCH PACK ONLY

Partial Disassembly

This procedure can be performed on the motorcycle without removing the clutch shell or hub.

1. Remove primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Removal.
2. See Figure 5-29. Remove six bolts (1) (metric) to release diaphragm spring retainer (2) from clutch hub. Loosen each bolt gradually and in a star sequence around the hub.
3. Remove diaphragm spring retainer, diaphragm spring (3) and pressure plate (4) from clutch hub.
4. Remove friction plates (5, 7), steel plates (6), damper spring (8) and damper spring seat (9) from clutch hub (11). Continue with Cleaning And Inspection.

Cleaning And Inspection

WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

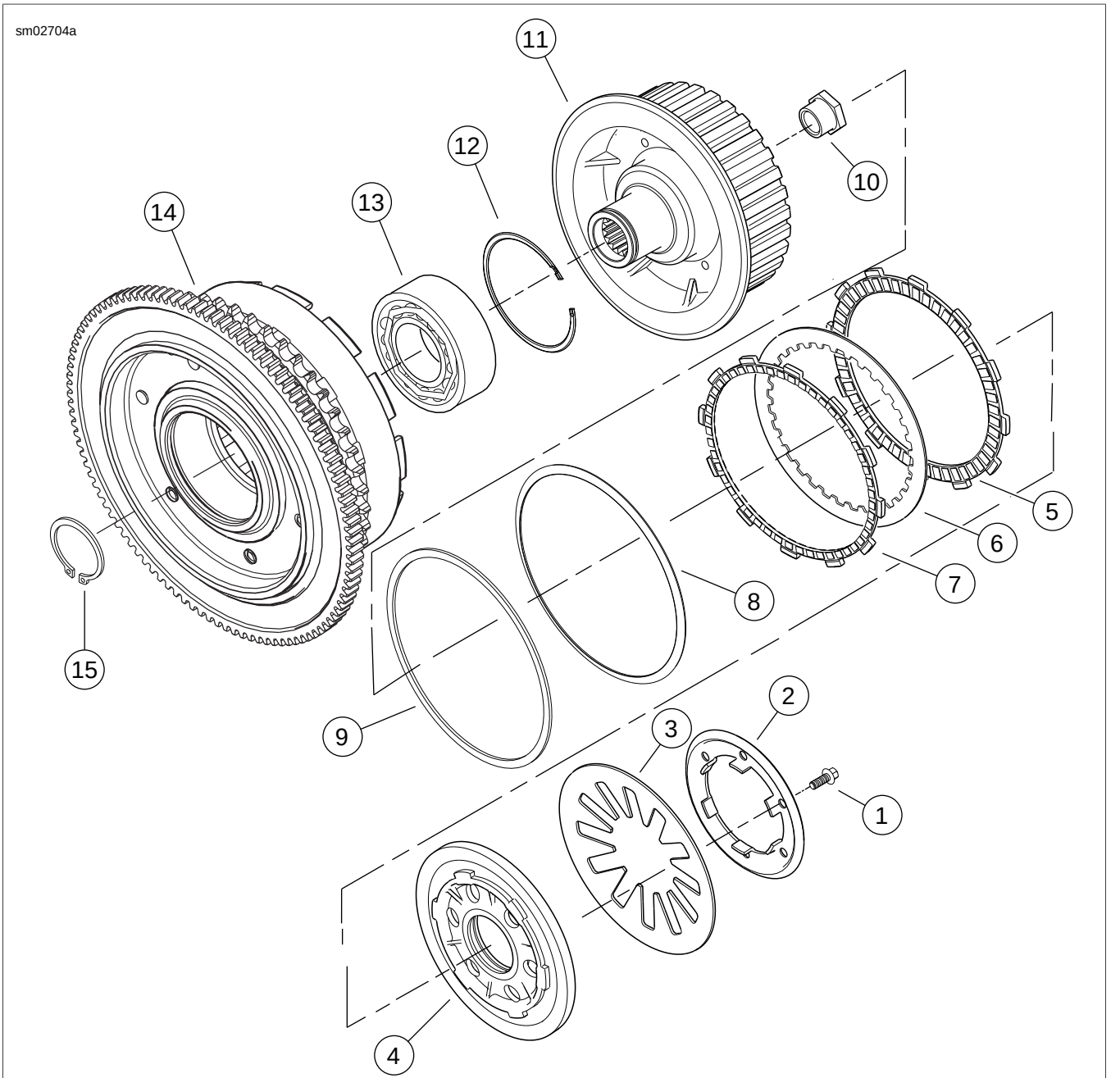
1. Wash all parts in cleaning solvent, except for friction plates and bearing, if removed. Blow parts dry with low pressure compressed air.
2. Check **friction plates** as follows:
 a. Blow off all lubricant from the friction plates. Do not wipe off with a rag.
 b. Measure the thickness of each plate with a dial caliper or micrometer.
 c. If the thickness of any plate is less than 0.143 in. (3.62 mm), discard all friction plates and replace with an entirely **new** set.
 d. Look for worn or damaged fiber surface material (both sides).

NOTE

Replace all nine friction plates with an entirely new set if any individual plate shows evidence of wear or damage. Submerge and soak all friction plates in FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt.) for at least five minutes.

3. Check the **steel plates** as follows:
 a. Discard any plate that is grooved or bluish in color. Blue plates are likely warped or distorted.
 b. Check each plate for distortion. Lay the plate on a precision flat surface. Insert a feeler gauge between the plate and the flat surface in several places. Replace any steel plate that is warped more than 0.006 in. (0.15 mm).
4. Holding the clutch hub, rotate the clutch shell to check bearing for smoothness. Replace the bearing if it runs rough, binds or has any end play.
5. Check the primary chain sprocket and the starter ring gear on the clutch shell. Replace the clutch shell if either sprocket or ring gear are badly worn or damaged.
6. Check the slots that mate with the clutch plates on both the clutch shell and hub. Replace shell or hub if slots are worn or damaged.
7. Check the diaphragm spring and diaphragm spring retainer for cracks or bent tabs. Obtain a **new** diaphragm spring or diaphragm spring retainer if either condition exists.

DIGITAL TECHNICIAN HARLEY-DAVIDSON



1. Bolt (6) (metric)
2. Diaphragm spring retainer
3. Diaphragm spring
4. Pressure plate
5. Friction plate (9)
6. Steel plate (8)
7. Narrow friction plate
8. Damper spring
9. Damper spring seat
10. Mainshaft nut (metric)
11. Clutch hub
12. Retaining ring
13. Bearing
14. Clutch shell
15. Retaining ring

Figure 5-29. Clutch Shell Assembly

Assembly

NOTE

Submerge and soak all friction plates in FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt.) for at least five minutes.

1. See Figure 5-30. Install the narrow friction plate on the clutch hub. Engage tabs on plate with slots in clutch shell.
2. See Figure 5-29. Install damper spring seat (9) on clutch hub (11). It must sit inboard of narrow friction plate (7).

NOTE

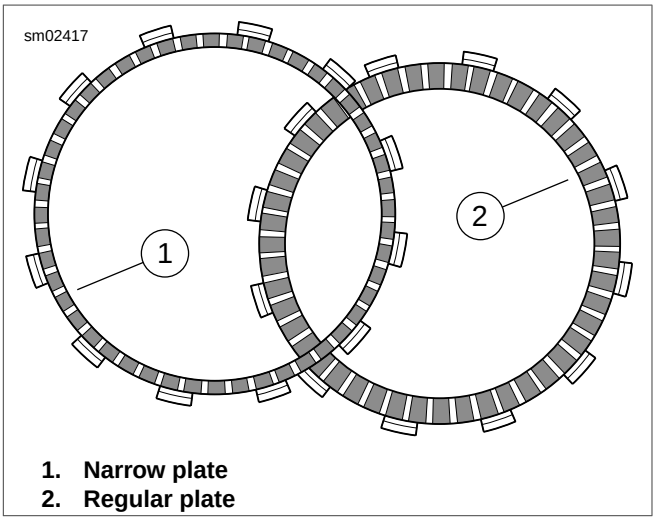
See Figure 5-35. Notice damper spring (4) orientation with respect to damper spring seat (3).

3. See Figure 5-29. Install damper spring (8) on clutch hub with the concave side out (facing away from damper spring seat).
4. Install a steel plate (6) with round edge outward and then a friction plate (5) on the clutch hub. Install seven remaining sets in the same manner, alternating between steel plates and friction plates.
5. Install pressure plate (4) on clutch hub aligning holes in plate with threaded bosses on hub.
6. Seat diaphragm spring (3) in recess of pressure plate with the concave side inward.
7. Align holes in diaphragm spring retainer (2) with threaded bosses on clutch hub. Tabs on spring retainer contact flats on inboard side of bosses.
8. Install six bolts (1) (metric) to secure diaphragm spring retainer to clutch hub. Alternately tighten the bolts to 90-110 **in-lbs** (10.2-12.4 Nm).

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

9. Install primary chaincase cover and gasket. See 5.3 PRIMARY CHAINCASE COVER, Installation.
10. Fill primary chaincase with lubricant. See 1.7 PRIMARY CHAIN, Chaincase Lubricant.



1. **Narrow plate**
2. **Regular plate**

Figure 5-30. Friction Plates

CLUTCH PACK AND BEARING

Complete Disassembly

1. Remove the primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Removal.
2. Remove clutch assembly. See 5.4 DRIVE COMPONENTS, Removal.
3. Follow all partial disassembly information under 5.6 CLUTCH, Clutch Pack Only.

NOTE

To avoid possible bearing damage, do not disassemble the clutch shell and hub assembly unless the bearing, hub or shell require replacement. Replace the bearing if disassembled.

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

4. See Figure 5-31. With the transmission side up, remove retaining ring from clutch hub groove.
5. See Figure 5-32. Supporting clutch shell in same orientation, use arbor press and a suitable press plug to press hub from bearing in clutch shell.
6. See Figure 5-33. With the transmission side up, remove retaining ring from groove in clutch shell bore.
7. See Figure 5-34. Turn clutch shell over so that transmission side is down. Using arbor press and a suitable press plug, press on inner race to remove bearing from clutch shell bore.
8. Continue with Cleaning and Inspection found under 5.6 CLUTCH, Clutch Pack Only.



Figure 5-31. Clutch Hub Retaining Ring



Figure 5-32. Pressing Clutch Hub From Bearing

Assembly

1. Orient clutch shell in arbor press with transmission side up. Be sure to support clutch shell bore on sprocket side to avoid damage to ears on clutch basket. Using a suitable press plug, press against outer race until bearing contacts shoulder in clutch shell bore.

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

2. See Figure 5-33. Install retaining ring in groove of clutch shell bore so that flat side of retaining ring is towards bearing.
3. Turn clutch shell over so sprocket side is up. Center hub in bearing. Be sure that bearing inner race is supported with sleeve on transmission side. Press hub into bearing until hub shoulder contacts bearing inner race.
4. See Figure 5-31. Turn assembly over so that the transmission side is up. Install retaining ring in groove of clutch hub.
5. Place clutch assembly on bench oriented with the transmission side down.
6. Soak all friction and steel plates in FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt.) for at least five minutes.
7. See Figure 5-35. Install the narrow friction plate on the clutch hub engaging tabs on plate with slots in clutch shell.
8. Install damper spring seat on clutch hub so that it seats inboard of narrow friction plate.
9. Install damper spring on clutch hub with the concave side up (facing opposite damper spring seat).
10. Install a steel plate and than a friction plate on the clutch hub. Install seven remaining sets in the same manner, alternating between steel plates and frictions plates.
11. Install pressure plate on clutch hub aligning holes in plate with threaded bosses on hub.
12. See Figure 5-36. Seat diaphragm spring (1) in recess of pressure plate with the concave side down.
13. Align holes in diaphragm spring retainer with threaded bosses on clutch hub. Tabs on spring retainer contact flats on inboard side of bosses.
14. Install six bolts (5) (metric) to secure diaphragm spring retainer to clutch hub. Alternately tighten 90-110 **in-lbs** (10.2-12.4 Nm).
15. Install clutch. See 5.4 DRIVE COMPONENTS, Installation.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

16. Install primary chaincase cover and gasket. See 5.3 PRIMARY CHAINCASE COVER, Installation.
17. Fill primary chaincase with lubricant. See 1.7 PRIMARY CHAIN, Chaincase Lubricant.



Figure 5-33. Install Clutch Shell Retaining Ring with Flat Side Against Bearing

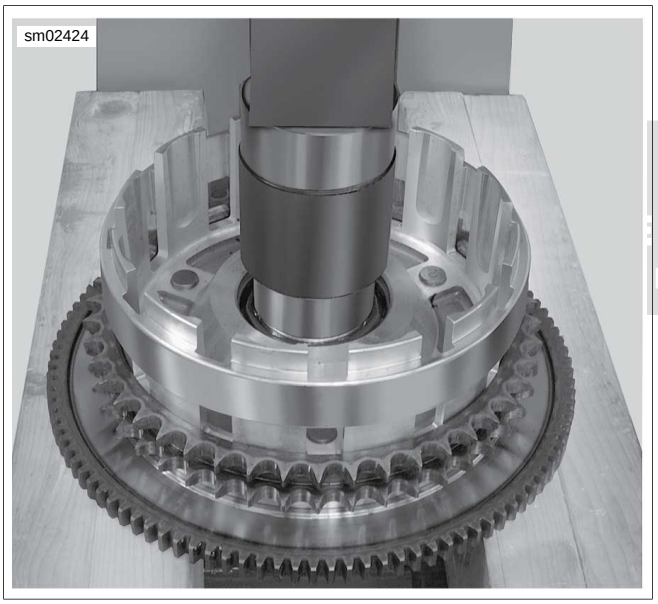
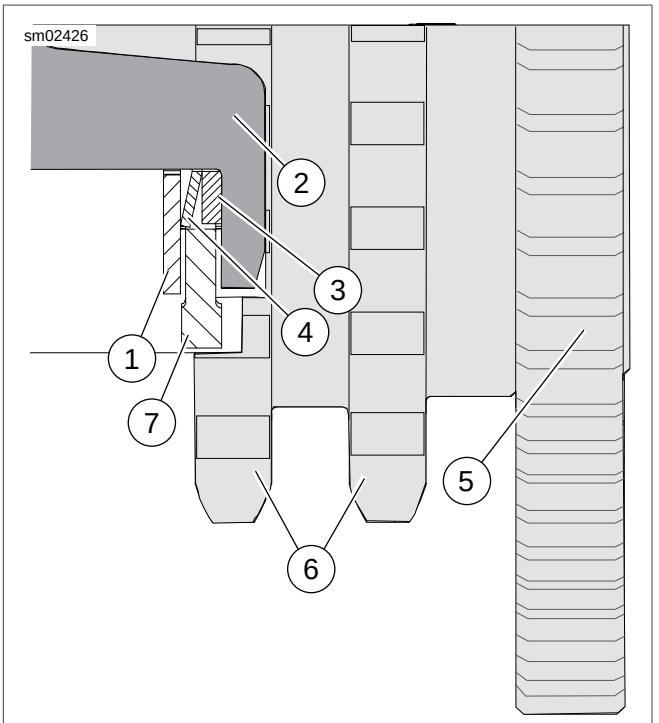
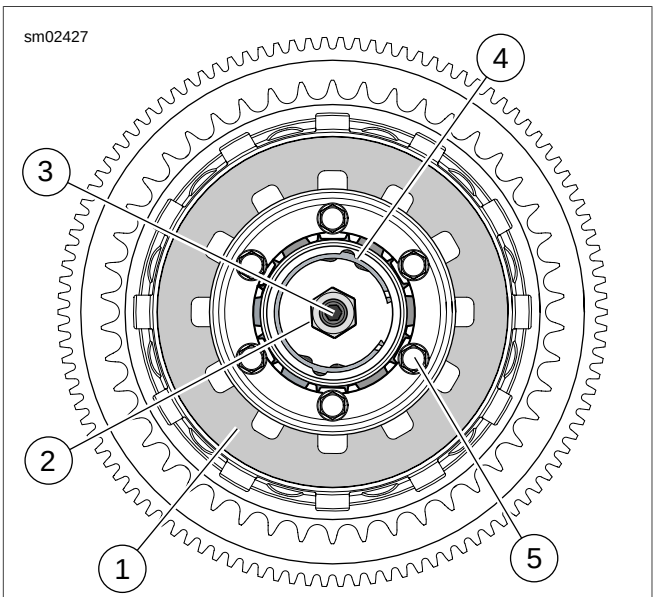


Figure 5-34. Pressing Bearing From Clutch Shell



1. **Steel plate**
2. **Clutch hub**
3. **Damper spring seat**
4. **Damper spring**
5. **Starter ring gear**
6. **Primary chain sprocket**
7. **Narrow friction plate**

Figure 5-35. Clutch Stackup



1. **Diaphragm spring**
2. **Jam nut**
3. **Adjuster screw**
4. **Retaining ring**
5. **Bolt (6) (metric)**

Figure 5-36. Assembled Clutch

TRANSMISSION SPROCKET 5.7

REMOVAL

PART NUMBER	TOOL NAME
HD-46282A	FINAL DRIVE SPROCKET LOCKING TOOL
HD-47910	MAINSHAFT LOCKNUT WRENCH
HD-94660-2	PILOT

1. Remove primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.
2. Loosen drive belt tension. See 1.13 REAR BELT DEFLECTION.

NOTE

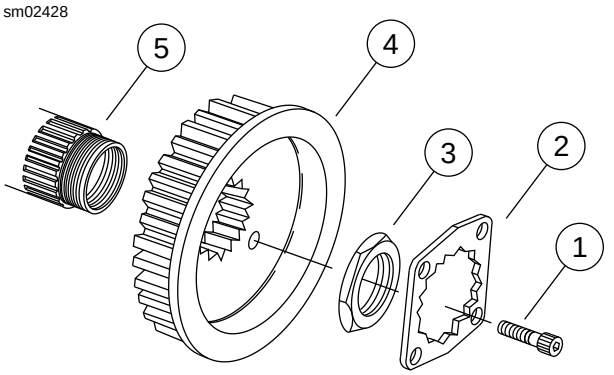
Remove sprocket nut only while transmission is installed in frame. Failure to do so will result in damage to transmission and/or transmission stand.

3. See Figure 5-37. Remove two screws (1) and lockplate (2).
4. See Figure 5-38. Install FINAL DRIVE SPROCKET LOCKING TOOL (Part No. HD-46282A) (2) so that arm of tool rests against bottom of rear fork pivot (1).

NOTE

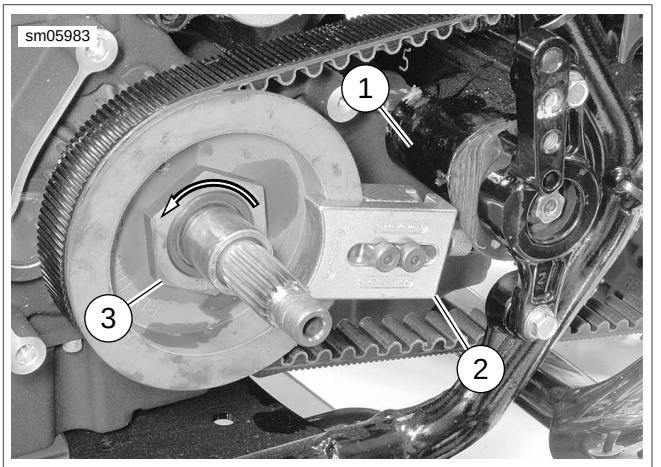
Sprocket nut has a right-hand thread.

5. Install PILOT (Part No. HD-94660-2) on mainshaft.
6. Remove the sprocket nut (3) using MAINSHAFT LOCKNUT WRENCH (Part No. HD-47910) (1).
7. Remove sprocket, allowing belt to slip from sprocket as sprocket is removed.



1. **Screw (2)**
2. **Lockplate**
3. **Sprocket nut**
4. **Sprocket**
5. **Main drive gear**

Figure 5-37. Transmission Sprocket



1. **Rear fork pivot**
2. **Final drive sprocket locking tool**
3. **Mainshaft locknut**

Figure 5-38. Sprocket Nut Removal

CLEANING AND INSPECTION

1. Using a non-volatile cleaning solvent, clean sprocket of all grease and dirt.
2. Inspect belt and sprocket. See 1.12 REAR BELT AND SPROCKETS, Inspection.
3. Inspect both main drive gear and mainshaft seals. Replace if damaged.

INSTALLATION

PART NUMBER	TOOL NAME
HD-46282A	FINAL DRIVE SPROCKET LOCKING TOOL
HD-47910	MAINSHAFT LOCKNUT WRENCH
HD-94660-2	PILOT

NOTE

Install sprocket nut only while transmission is installed in frame. Failure to do so will result in damage to transmission and/or transmission stand.

1. Place transmission sprocket in position. Install the belt on the sprocket as the sprocket is installed.
2. If reusing the sprocket nut, apply Loctite High Strength Threadlocker 271 (red) to the threads of the sprocket nut.

NOTES

- *Exercise caution to avoid getting oil on the threads of the sprocket nut or the integrity of the lock patch may be compromised.*
- *The transmission sprocket nut has **right-hand** threads. Turn the nut **clockwise** to install on the main drive gear.*

3. See Figure 5-37. Carefully spread a small quantity of clean engine oil on the inside face of the sprocket nut (3) and the outside face of the sprocket (4) where the surfaces of

the two parts contact each other. Install the sprocket nut until finger tight.

4. See Figure 5-39. Lock transmission sprocket with the FINAL DRIVE SPROCKET LOCKING TOOL (Part No. HD-46282A) (2). Arm of locking tool must rest against upper portion of rear fork pivot (1).
5. Install PILOT (Part No. HD-94660-2) on mainshaft.
6. Using MAINSHAFT LOCKNUT WRENCH (Part No. HD-47910), tighten sprocket nut to 100 ft-lbs (136.0 Nm) initial torque.
7. See Figure 5-37. Relocate locking tool as when removing sprocket nut.
8. Loosen sprocket nut one full turn.
9. Relocate locking tool as shown in Figure 5-39.
10. Tighten sprocket nut to 35 ft-lbs (47.5 Nm).
11. See Figure 5-40. Scribe lines (3) on the transmission sprocket nut (1). Continue the lines onto the transmission sprocket (2) as shown.
12. Tighten sprocket nut an additional 35-40 degrees.
13. Install lockplate over transmission sprocket nut so that two of lockplate's four drilled holes align with sprocket's two tapped holes. To find the best fit, lockplate can be rotated to a number of positions and can be placed with either side facing sprocket.

NOTE

Maximum allowable tightening of sprocket nut is 45 degrees of clockwise rotation after a torque of 35 ft-lbs (47.5 Nm). Do not loosen sprocket nut to align holes or nut will be under tightened.

14. If holes in lockplate do not align with those in sprocket, continue to tighten sprocket nut (up to the 45 degrees maximum) until sprocket and lockplate holes are in alignment.

NOTES

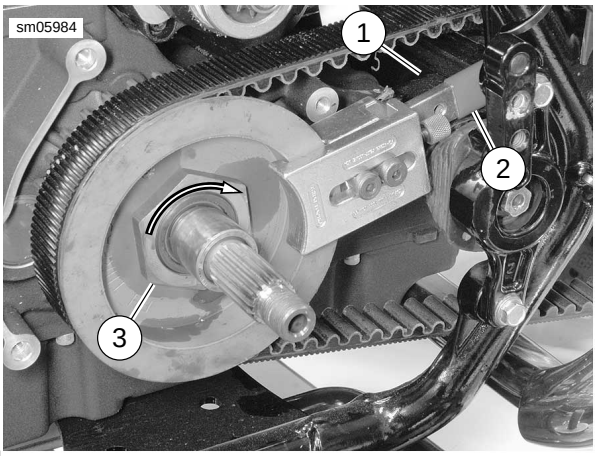
- ***New** screws have LOCTITE patches.*
- *Screws can be re-used up to three times if LOCTITE High Strength Threadlocker 271 (red) is applied before installation.*
- *To be sure of the lockplate's security, BOTH screws must be installed in the lockplate.*

15. See Figure 5-37. Install two screws (1) to secure lockplate (2) to sprocket (4).
16. Tighten screws to 84-132 **in-lbs** (9.5-14.9 Nm).
17. Install primary chain assembly. See 5.4 DRIVE COMPONENTS.

NOTE

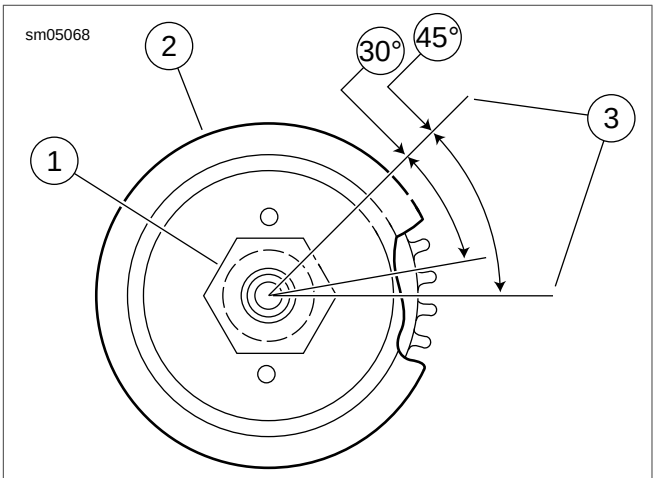
The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

18. Install primary chaincase cover and **new** gasket. See 5.3 PRIMARY CHAINCASE COVER.
19. Fill primary chaincase with lubricant. See 1.7 PRIMARY CHAIN.
20. Verify pivot shaft torque. See 2.24 REAR FORK.
21. Adjust belt tension. See 1.13 REAR BELT DEFLECTION.



1. **Rear fork pivot**
2. **Final drive sprocket locking tool**
3. **Mainshaft locknut**

Figure 5-39. Sprocket Nut Installation



1. **Transmission sprocket nut**
2. **Transmission sprocket**
3. **Scribed lines**

Figure 5-40. Transmission Sprocket Nut Final Tightening

DRIVE BELT 5.8

REMOVAL AND ADJUSTMENT

Adjustment

See 1.13 REAR BELT DEFLECTION, Setting Belt Deflection.

Removal

1. Remove rear wheel and rear fork. See 2.24 REAR FORK.
2. Remove primary chain, clutch, engine compensating sprocket, and chain adjuster as an assembly. See 5.4 DRIVE COMPONENTS.
3. Remove primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING, Removal.
4. Remove belt from transmission sprocket.

INSTALLATION

⚠WARNING

Never bend belt forward into a loop smaller than the drive sprocket diameter. Never bend belt into a reverse loop. Over bending can damage belt resulting in premature failure, which could cause loss of control and death or serious injury. (00339a)

1. Install belt over transmission sprocket.
2. Install the primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING, Installation.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

3. Install primary chain assembly and primary chaincase cover. Fill primary chaincase with lubricant. See 5.4 DRIVE COMPONENTS.
4. Install rear fork and rear wheel. See 2.24 REAR FORK.
5. Adjust belt tension. See 1.13 REAR BELT DEFLECTION.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

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DIGITAL TECHNICIAN® II
HARLEY-DAVIDSON®

NOTES

FASTENER TORQUE VALUES 6.1

FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

FASTENER	TORQUE VALUE		NOTES
Clutch cable fitting	90-120 **in-lbs**	10.2-13.6 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Clutch release cover screws	84-108 **in-lbs**	9.5-12.2 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Mainshaft/countershaft nuts	55-65 ft-lbs	74.6-88.2 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm	6.8 TRANSMISSION CASE, Installation
Shift drum detent arm fastener	120-150 **in-lbs**	13.6-17.0 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shift drum lock plate fasteners	57-63 **in-lbs**	6.4-7.1 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shifter rod lever screw	18-22 ft-lbs	24.4-29.8 Nm	6.8 TRANSMISSION CASE, Assembly
Shifter rod locknut	80-120 **in-lbs**	9.0-13.6 Nm	6.4 SHIFTER LINKAGE, Shifter Rod
Side door fasteners	13-18 ft-lbs	17.6-24.4 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.8 TRANSMISSION CASE, Installation
Transmission mounting bolts, final torque	34-39 ft-lbs	46.1-52.9 Nm	6.8 TRANSMISSION CASE, Installation
Transmission mounting bolts, initial torque	15 ft-lbs	20.3 Nm	6.8 TRANSMISSION CASE, Installation
Transmission top cover	84-132 **in-lbs**	9.5-14.9 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
VSS fastener	84-132 **in-lbs**	9.5-14.9 Nm	6.8 TRANSMISSION CASE, Installation

DIGITAL TECHNICIAN

SPECIFICATIONS: TRANSMISSION 6.2

SPECIFICATIONS

Table 6-1. Transmission Specifications

TRANSMISSION	DATA
Type	6-speed forward constant mesh
FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT	Part No. 99851-05 (qt)
Capacity	32 oz.
	946.4 ml

Table 6-2. Gear Specifications

GEAR	GEAR RATIO
First (low)	3.34
Second	2.31
Third	1.72
Fourth	1.39
Fifth	1.18
Sixth (high)	1.00

NOTE

Final gear ratios indicate the number of mainshaft revolutions required to drive the output sprocket one revolution.

SERVICE WEAR LIMITS

Table 6-3. Main Drive Gear Specifications

MAIN DRIVE GEAR (6th)	IN.	MM
Bearing fit in transmission case (loose)	0.0003-0.0017	0.0076-0.043
Fit in bearing (press-fit)	0.001-0.003	0.025-0.076
End play	none	none

Table 6-4. Mainshaft Tolerance Specifications

MAINSHAFT TOLERANCE	IN.	MM
Mainshaft runout	0.000-0.003	0.00-0.08
Mainshaft end play	none	none
5th gear end play (axial)	0.002-0.026	0.05-0.66
5th gear clearance (radial)	0.0004-0.0020	0.009-0.052
Main drive gear (6th) fit	0.0009-0.0022	0.023-0.056

Table 6-5. Countershaft Tolerance Specifications

COUNTERSHAFT TOLERANCE	IN.	MM
Countershaft runout	0.000-0.003	0.00-0.08
Countershaft end play	0.001-0.003	0.025-0.08
1st gear end play (axial)	0.001-0.023	0.03-0.58
1st gear clearance (radial)	0.0004-0.0020	0.010-0.052
2nd gear end play (axial)	0.001-0.40	0.03-1.02
2nd gear clearance (radial)	0.0004-0.0020	0.010-0.052
3rd gear end play (axial)	0.001-0.042	0.03-1.07
3rd gear clearance (radial)	0.0004-0.0020	0.010-0.052
4th gear end play (axial)	0.001-0.028	0.03-0.71
4th gear clearance (radial)	0.0004-0.0020	0.010-0.052

Table 6-6. Shifter Dog Wear Limit Specifications

SHIFTER DOG	IN.	MM
1st	0.015-0.112	0.381-2.845
2nd	0.021-0.136	0.533-3.454
3rd	0.014-0.118	0.356-2.997
4th	0.033-0.115	0.838-2.921
5th	0.016-0.115	0.406-2.921
6th	0.026-0.123	0.660-3.124

Table 6-7. Side Door Bearing Specifications

SIDE DOOR BEARING	IN.	MM
Fit in side door (tight)	0.0001-0.0014	0.0025-0.0356
Fit on countershaft (tight)	-0.0007	-0.018
Fit on countershaft (loose)	+0.001	+0.025
Fit on mainshaft (tight)	-0.0007	-0.018
Fit on mainshaft (loose)	+0.001	+0.025

Table 6-8. Shifter Fork Specifications

SHIFTER FORKS	IN.	MM
Shifter fork to cam groove end play	0.004-0.012	0.102-0.305
Shifter fork to dog ring end play	0.004-0.016	0.102-0.4060
First and second gear shift fork pad thickness wear limit	0.258	6.55
Third and fourth gear shift fork pad thickness wear limit	0.198	5.03
Fifth and sixth gear shift fork pad thickness wear limit	0.258	6.55

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TRANSMISSION 6.3

POWER FLOW

See Figure 6-1. The 6-speed transmission consists of two parallel shafts supporting six gears each. The longer, or mainshaft (7), also supports the clutch and serves as the input shaft. The shorter shaft is called the countershaft (8).

Each gear on the mainshaft is in constant mesh with a corresponding gear on the countershaft. Each of these six pairs of gears makes up a different speed in the transmission.

The transmission gears are divided into two types, gears that rotate with the shaft, and freewheeling gears that ride on bearings and spin freely on the shaft. A gear that rotates with the shaft always meshes with a freewheeling gear. Also, three dog rings are able to slide sideways on the shaft. These dog rings are used to change transmission speeds. The dogs, or projections, on the sides of the dog rings, engage dogs on adjacent freewheeling gears, transmitting power through the transmission.

Gear shifting is accomplished by three forks which fit into grooves machined into the dog rings that slide on the guide hubs. The position of the shifter forks is controlled by a drum-shaped shifter cam located in the transmission side door.

Neutral

Power is introduced to the transmission through the clutch. In neutral, with the clutch engaged, the mainshaft 1st, 2nd, 3rd and 4th gears are rotating, but no power is transferred to the countershaft since countershaft 1st, 2nd, 3rd and 4th gears are freewheeling gears.

1st Gear

When the transmission is shifted into first gear, the dog ring between countershaft 1st and 2nd, which rotates with the countershaft, engages countershaft 1st, which has been spinning freely on the countershaft driven by mainshaft 1st.

Now countershaft 1st is no longer freewheeling, but locked to the countershaft causing the countershaft and countershaft 6th to turn. Countershaft 6th transmits the power to the main drive gear and the sprocket as shown (1).

2nd Gear

Second gear is engaged when the dog ring between countershaft 1st and 2nd is shifted out of countershaft 1st and engages countershaft 2nd. This locks countershaft 2nd to the countershaft to complete the power flow as shown (2).

3rd Gear

Two shifter forks are used to make the shift from second to third. One fork moves the dog ring between countershaft 1st and 2nd to its neutral position, while another fork engages the dog ring between countershaft 3rd and 4th with countershaft 3rd. This locks countershaft 3rd to the countershaft to complete the power flow as shown (3).

4th Gear

Fourth gear is engaged when the dog ring between countershaft 3rd and 4th is shifted out of countershaft 3rd and engages countershaft 4th. This locks countershaft 4th to the countershaft to complete the power flow as shown (4).

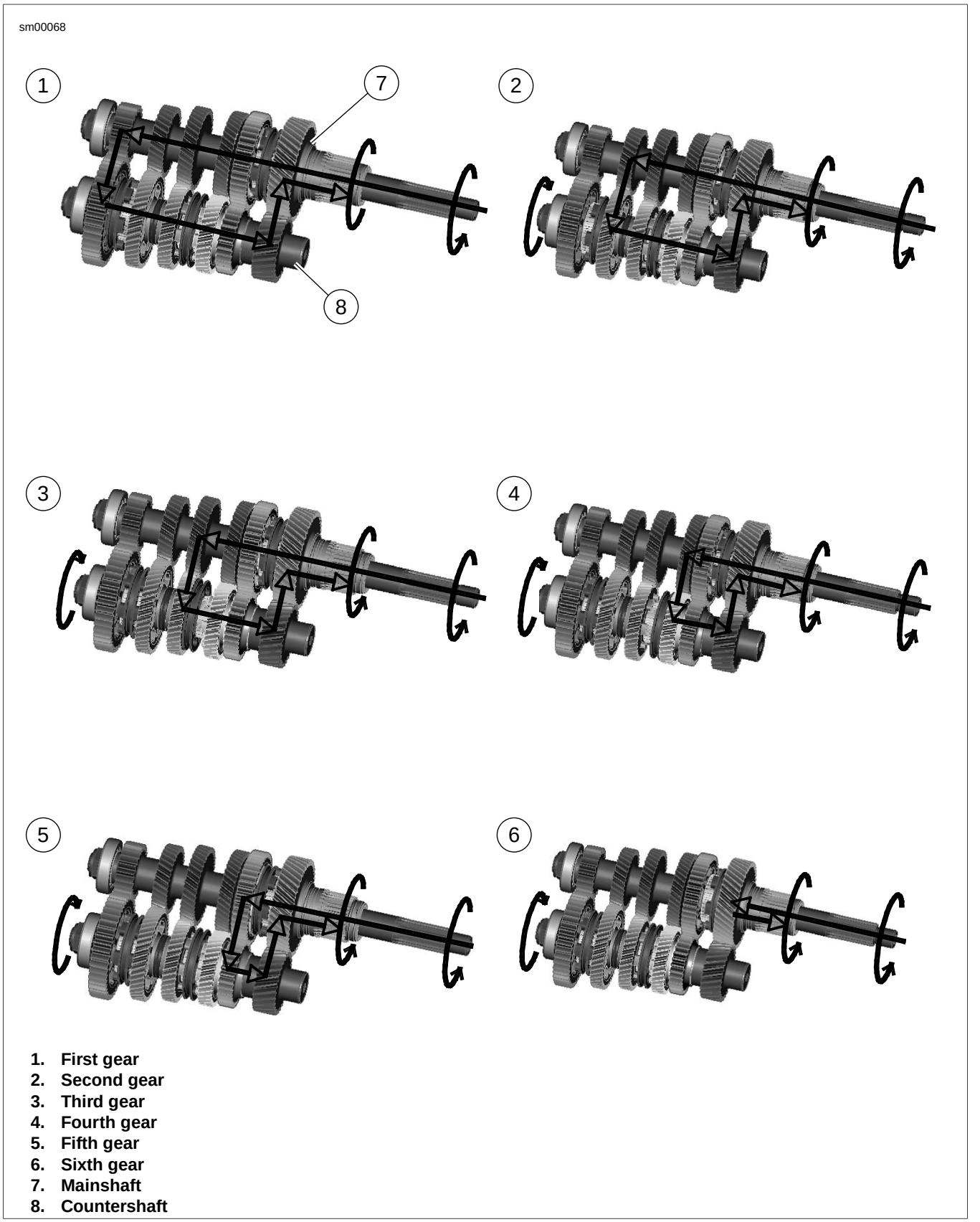
5th Gear

Two shifter forks are used to make the shift from fourth to fifth. One fork moves the dog ring between countershaft 3rd and 4th to its neutral position, while another fork engages the dog ring between mainshaft 5th and 6th with mainshaft 5th. This locks mainshaft 5th to the mainshaft to complete the power flow as shown (5).

6th Gear

The shift from fifth to sixth gear occurs when the dog ring between mainshaft 5th and 6th is shifted out of mainshaft 5th, and is shifted directly into the main drive gear (6th gear). The main drive gear is locked to the mainshaft resulting in a direct one-to-one drive ratio from the clutch to the sprocket as shown (6).

TECHMANUAL HARLEY-DAVIDSON



1. First gear
2. Second gear
3. Third gear
4. Fourth gear
5. Fifth gear
6. Sixth gear
7. Mainshaft
8. Countershaft

Figure 6-1. Transmission Power Flow

SHIFTER LINKAGE 6.4

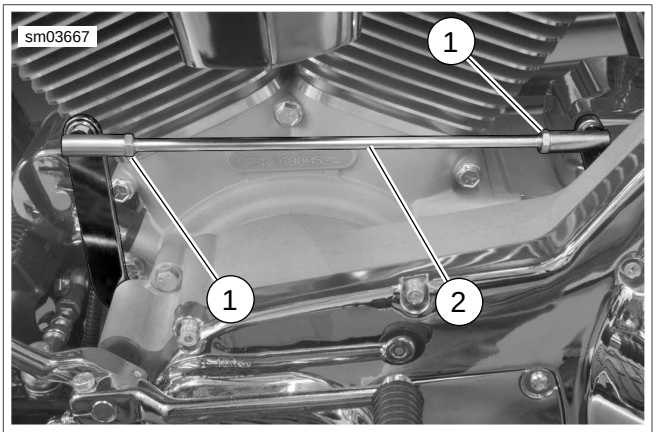
SHIFTER ROD

The shifter rod is set at the factory and should not need adjustment under normal circumstances. However, if full engagement or full lever travel is not achieved, adjust the shifter rod.

NOTE

To ensure proper gear engagement and avoid possible damage to transmission, the shift levers should not contact the footboard when shifting.

1. See Figure 6-2. Remove locknut, lockwasher and flat washer to free front end of shifter rod from inner shift arm.
2. Loosen locknuts (1) and adjust rod (2) as necessary.
3. Install flat washer, lockwasher and locknut to fasten front end of shifter rod to inner shift arm.
4. Tighten locknuts (1) to 80-120 **in-lbs** (9.0-13.6 Nm).



1. Locknut (2)
2. Shifter rod

Figure 6-2. Shifter Rod

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

CLUTCH RELEASE COVER 6.5

REMOVAL AND DISASSEMBLY

1. Remove main fuse.
2. Remove exhaust system if needed. See 4.19 EXHAUST SYSTEM.
3. Drain transmission. See 1.8 TRANSMISSION LUBRICANT, Transmission Lubrication.

NOTE

Actuating the clutch hand lever after removing the six screws will help break the cover free.

4. See Figure 6-3. Remove the six screws that hold the clutch release cover in place. Remove the clutch release cover and discard the gasket.
5. Add freeplay to clutch cable. See 1.11 CLUTCH, Adjustment.

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

6. See Figure 6-4. Remove retaining ring (4). Lift inner ramp (5) and ramp coupling (3) out of clutch release cover. Disconnect clutch cable end (2) from the ramp coupling (3).
7. Remove coupling (3) from inner ramp.
8. See Figure 6-5. Remove balls (4) and outer ramp (2).
9. Unscrew clutch cable fitting from clutch release cover.

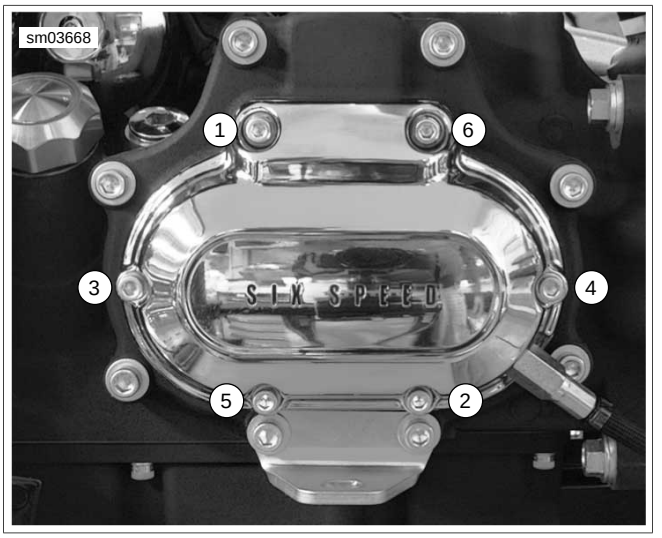
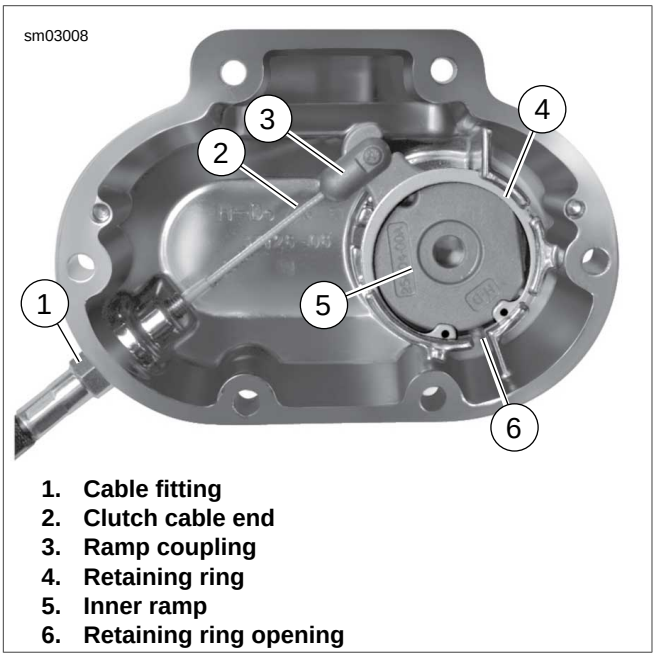
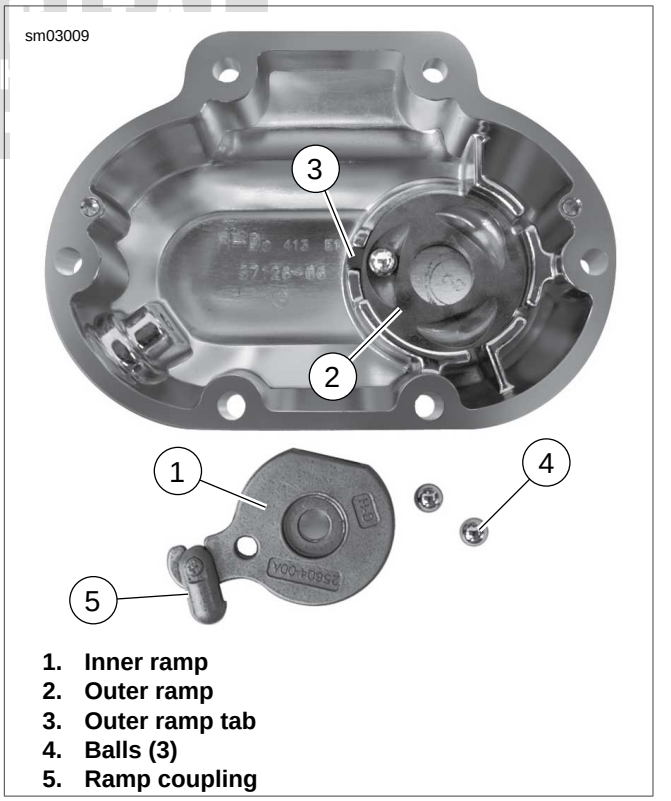


Figure 6-3. Clutch Release Cover Torque Sequence (Short Screws at Locations 1 and 6)



1. **Cable fitting**
2. **Clutch cable end**
3. **Ramp coupling**
4. **Retaining ring**
5. **Inner ramp**
6. **Retaining ring opening**

Figure 6-4. Clutch Cable Connection

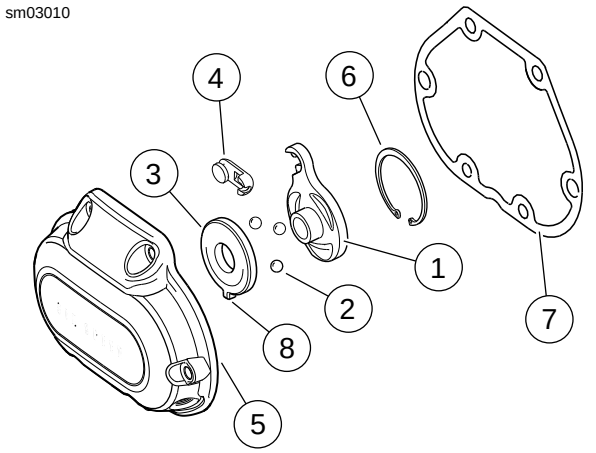


1. **Inner ramp**
2. **Outer ramp**
3. **Outer ramp tab**
4. **Balls (3)**
5. **Ramp coupling**

Figure 6-5. Coupling and Ramp Assembly

CLEANING AND INSPECTION

1. See Figure 6-6. Wash the ball and ramp mechanism components in cleaning solvent.
2. Inspect the three balls (2) and ball socket surfaces on ramps (1, 3) for wear, pitting, surface breakdown and other damage. Replace damaged parts.
3. Check fit of the ramp coupling (4) on inner ramp (1). Replace both parts if there is excessive wear.
4. Inspect the retaining ring (6) for damage or distortion.
5. Check clutch cable end for frayed or worn ends. Replace cable if damaged or worn. Check cable fitting o-ring for cuts, tears or signs of deterioration.
6. Check the bore in the cover (5) where the ramps (1, 3) are retained. There should be no wear that would cause the ramps to cock, causing improper clutch adjustment.



1. **Inner ramp**
2. **Balls (3)**
3. **Outer ramp**
4. **Ramp coupling**
5. **Clutch release cover**
6. **Retaining ring**
7. **Gasket**
8. **Tab**

Figure 6-6. Release Mechanism Assembly

ASSEMBLY AND INSTALLATION

NOTE

Replace cable fitting O-ring if damaged or deformed.

1. See Figure 6-4. Apply a drop of Loctite Threadlocker 243 (blue) to the clutch cable fitting (1) and install into clutch release cover. Do not tighten at this time.
2. See Figure 6-6. Place outer ramp (3) with ball socket side up in clutch release cover. Be sure tab (8) is in clutch release cover slot.
3. Apply a multi-purpose grease to the balls and outer ramp sockets. Place a ball in each of the outer ramp sockets.
4. See Figure 6-4. Connect cable end to ramp coupling (3). Install coupling on inner ramp (5) and place inner ramp and coupling in position in clutch release cover.

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

NOTE

Retaining ring opening (6) must be centered above the break in the ribbing at bottom of the clutch release cover.

5. Install retaining ring (4).
6. Verify that two dowel pins are in place on transmission side door flange. Place a **new** gasket on dowel pins.

NOTE

See Figure 6-3. Clutch release cover screws in positions (1) and (6) are shorter than the others.

7. See Figure 6-3. Install clutch release cover. Tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm) in sequence shown.
8. Tighten clutch cable fitting to 90-120 **in-lbs** (10.2-13.6 Nm).
9. Fill transmission to proper level with fresh transmission fluid. See 1.8 TRANSMISSION LUBRICANT, Transmission Lubrication.
10. Adjust clutch cable. See 1.11 CLUTCH.
11. Install exhaust system if removed. See 4.19 EXHAUST SYSTEM.
12. Install main fuse.

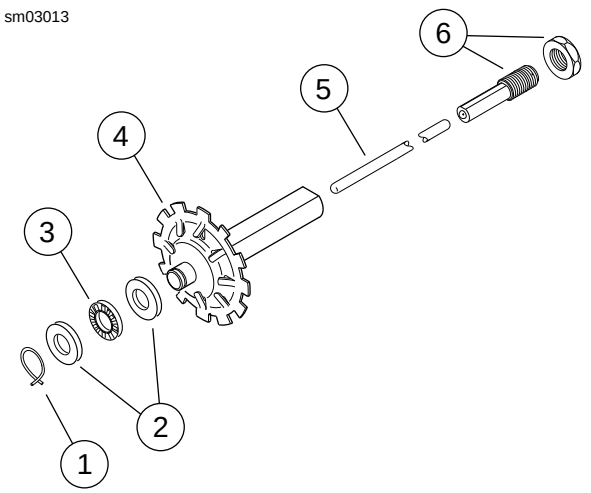
TRANSMISSION ASSEMBLY 6.6

REMOVAL

NOTE

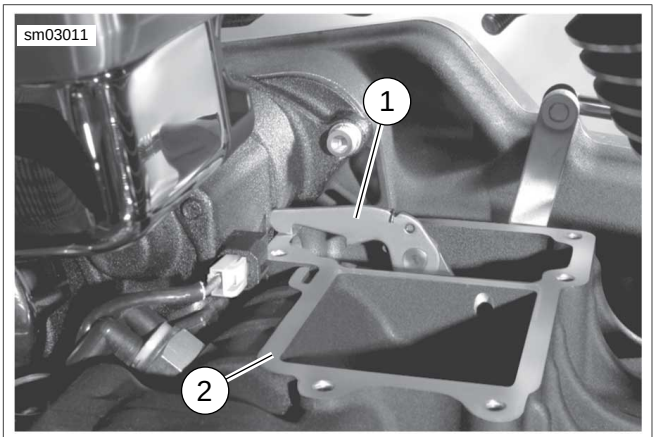
Leave the transmission case in the frame unless the case itself requires replacement. For illustration purposes, some photographs may show the case removed. For information on case removal see 6.8 TRANSMISSION CASE.

1. Remove exhaust system. See 4.19 EXHAUST SYSTEM.
2. Relieve drive belt tension. See 1.13 REAR BELT DEFLECTION.
3. Remove primary chaincase cover, clutch assembly, primary chain, compensating sprocket assembly and primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING, Removal.
4. Remove the bearing inner race from the transmission mainshaft. See 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race.
5. Remove the clutch release cover from the transmission side door. See 6.5 CLUTCH RELEASE COVER, Removal and Disassembly.
6. See Figure 6-7. Remove oil slinger assembly from mainshaft. Insert long rod through mainshaft bore and remove push rod.
7. Remove transmission top cover, leaving the cover gasket in place.
8. See Figure 6-8. Rotate the shifter pawl forward enough to raise the free end and place shifter cam pawl on top cover gasket.



1. **Retaining ring**
2. **Thrust washer (2)**
3. **Throw out bearing**
4. **Oil slinger**
5. **Push rod**
6. **Push rod end, left side**

Figure 6-7. Push Rod Assembly



1. **Shifter pawl**
2. **Top cover gasket surface**

Figure 6-8. Set Shifter Pawl on Gasket

NOTES

- *Remove and install sprocket nut only while transmission is in vehicle frame. Trying to remove and install sprocket nut with transmission in transmission stand may cause damage to transmission or stand.*
- *The main drive gear bearing and retainer must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.*

9. If main drive gear is to be removed, see 6.7 MAIN DRIVE GEAR AND BEARING, Removal.
10. Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear bearings.
11. See Figure 6-10. Remove the transmission side door mounting hardware. Remove exhaust bracket, if equipped.

NOTE

See Figure 6-9. Never attempt to remove side door by tapping on shafts from opposite side. Tapping them with a hammer will damage the side door bearings. If the side door sticks or binds on the ring dowels, pry open using indents at each side of side door.

12. Pry the side door loose and remove side door, mainshaft, countershaft and shifter cam from transmission case as an assembly. Discard gasket.

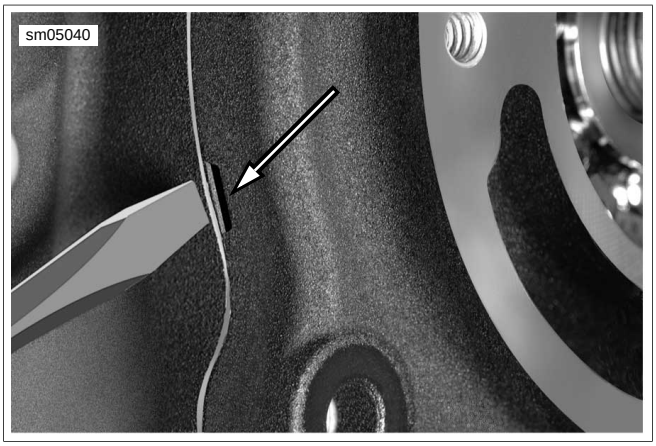
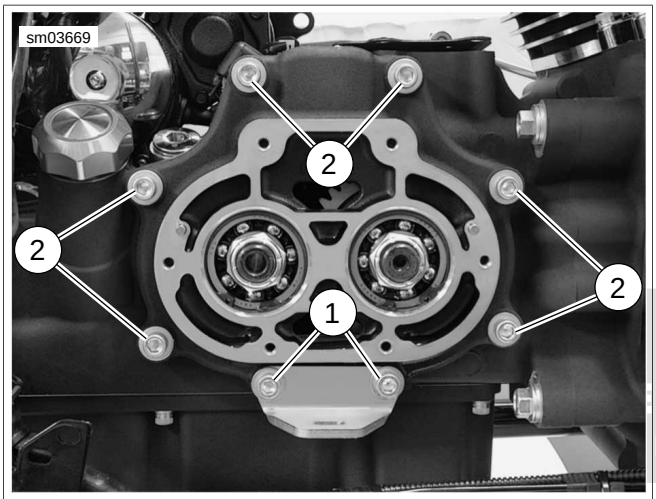


Figure 6-9. Side Door Pry Point



1. **Long screw (2)**
2. **Short screw (6)**

Figure 6-10. Side Door hardware

DISASSEMBLY

PART NUMBER	TOOL NAME
J-5586A	TRANSMISSION SHAFT RETAINING RING PLIERS

Shifter Cam/Shifter Forks

1. See Figure 6-11. With side door on end (shafts pointing upward), remove shift fork shafts using easy-out screw extractor (14) (non-flute design). Shafts have slight interference fit. Shafts can be reused, do not damage end of shaft. Mark end of shaft so same end can be reinserted during reassembly.

NOTE

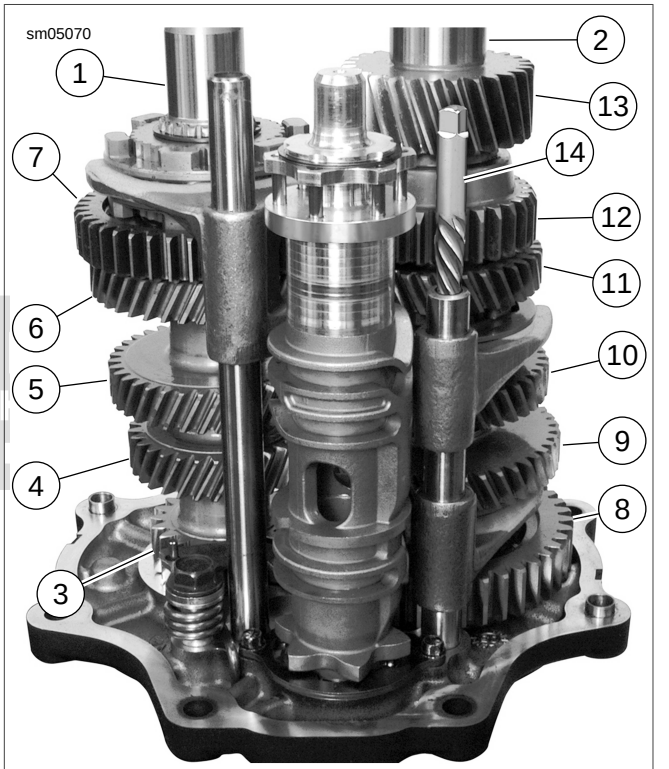
Shifter shafts have a slight interference fit. Shifter shafts can be reused, so avoid damaging end of shaft. Mark shafts so they can be reinstalled in original position during assembly.

2. Remove shift forks from dog rings.
3. See Figure 6-12. Remove lock plate fasteners (3) from lock plate (2). Discard fasteners.
4. See Figure 6-13. Insert screwdriver and gently pry back detent arm (4) to remove detent spring (3) tension from shift cam (5). Remove shift cam.
5. If servicing detent assembly, remove detent screw (2), detent arm (4), sleeve and detent spring (3). Discard detent screw.

NOTE

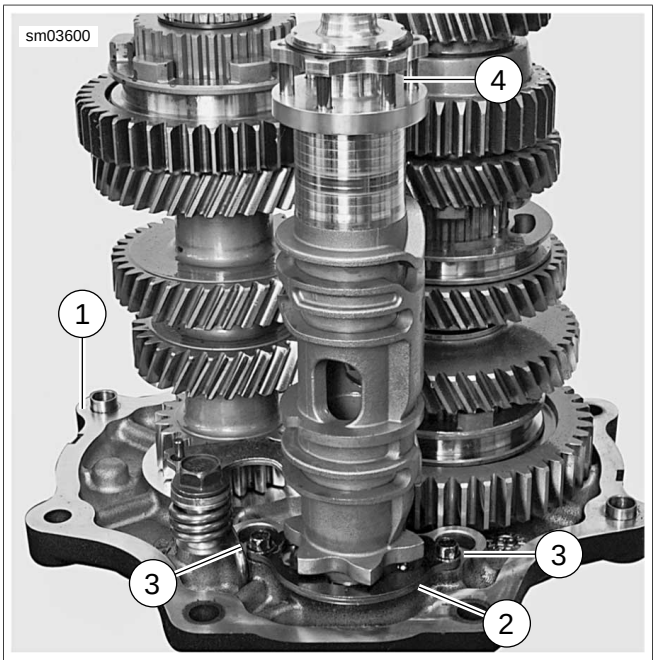
Although many transmission parts can be installed in either direction, make sure used parts are installed in same direction as when removed to prolong usable life.

6. See Figure 6-14. Using dog rings, lock two gears in place. Temporarily place transmission assembly into transmission case.
7. Remove mainshaft and countershaft locknuts.
8. Remove transmission assembly from transmission case.



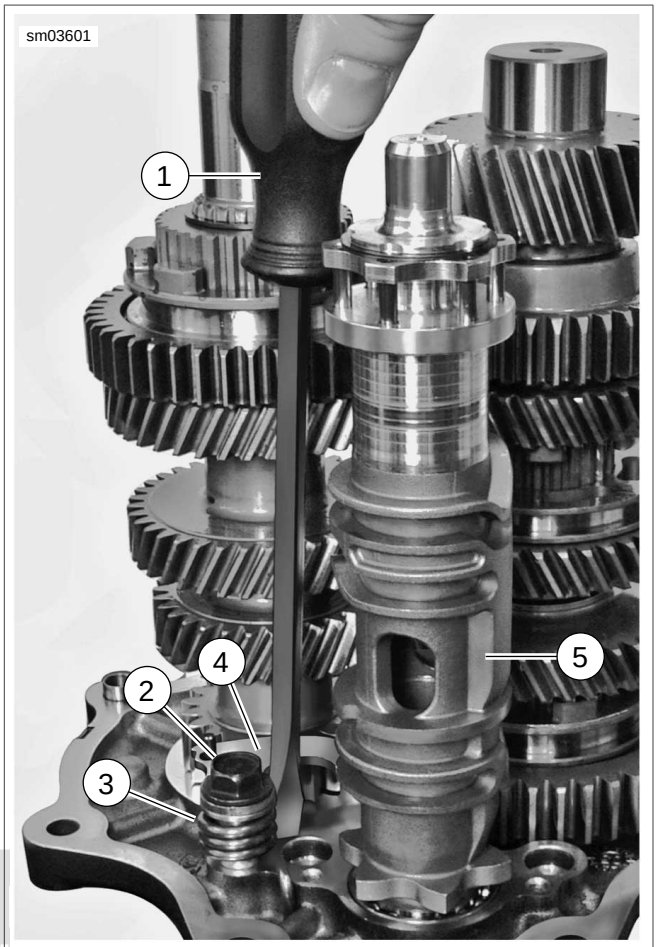
1. **Mainshaft**
2. **Countershaft**
3. **Mainshaft 1st gear**
4. **Mainshaft 2nd gear**
5. **Mainshaft 3rd gear**
6. **Mainshaft 4th gear**
7. **Mainshaft 5th gear**
8. **Countershaft 1st gear**
9. **Countershaft 2nd gear**
10. **Countershaft 3rd gear**
11. **Countershaft 4th gear**
12. **Countershaft 5th gear**
13. **Countershaft 6th gear**
14. **Screw extractor**

Figure 6-11. Gear Set



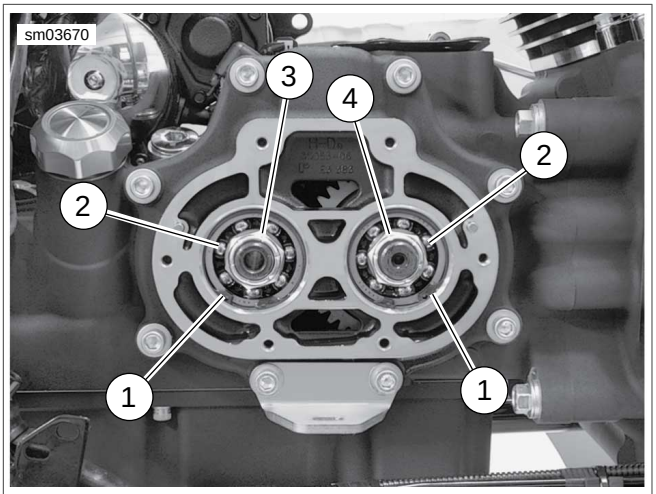
1. Side door
2. Lock plate
3. Lock plate fastener (2)
4. Shift cam

Figure 6-12. Shift Drum



1. Screwdriver
2. Detent fastener
3. Detent spring
4. Detent arm
5. Shift cam

Figure 6-13. Detent Assembly



1. Retaining ring (2)
2. Bearing (2)
3. Mainshaft locknut
4. Countershaft locknut

Figure 6-14. Side Door Locknuts

Mainshaft

WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

NOTE

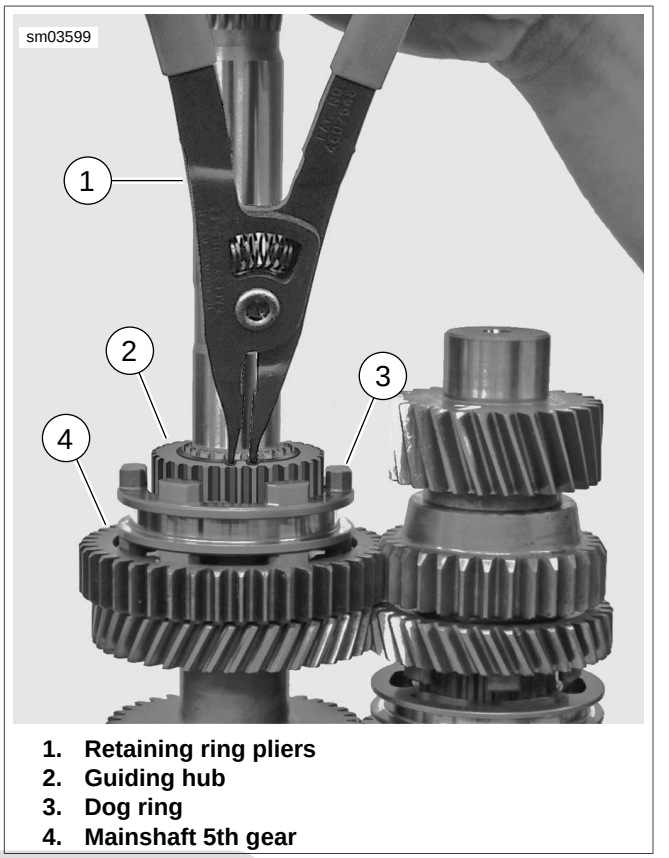
As mainshaft 4th gear, 3rd gear, 2nd gear and 1st gear are an integral part of the shaft, damage to any gear requires mainshaft replacement.

1. See Figure 6-15. Using TRANSMISSION SHAFT RETAINING RING PLIERS (Part No. J-5586A), remove retaining ring. Remove dog ring (3), guiding hub (2), mainshaft 5th gear (4) and bearing.

NOTE

Do not press directly on the end of the mainshaft. Place a spacer such as a washer between the end of the mainshaft and the press ram.

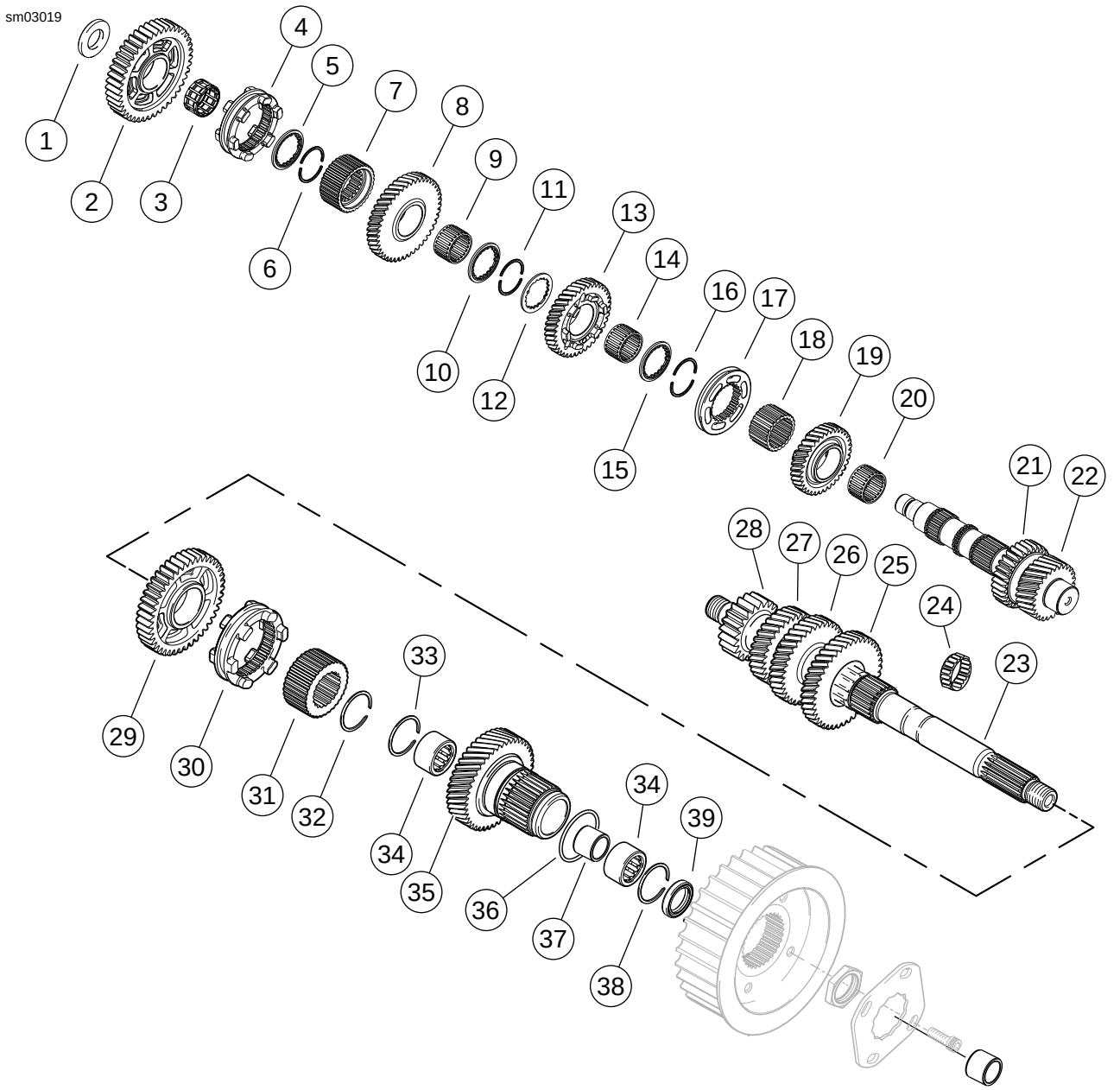
2. Place transmission assembly in arbor press and press mainshaft out of side door bearings.



1. **Retaining ring pliers**
2. **Guiding hub**
3. **Dog ring**
4. **Mainshaft 5th gear**

Figure 6-15. Mainshaft Retaining Ring

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Spacer
2. Countershaft 1st gear
3. Bearing
4. Dog ring
5. Lock ring
6. Securing segment (2)
7. Guiding hub
8. Countershaft 2nd gear
9. Bearing
10. Lock ring
11. Securing segment (2)
12. Internal spline washer
13. Countershaft 3rd gear
14. Bearing
15. Lock ring
16. Securing segment (2)
17. Dog ring
18. Guiding hub
19. Countershaft 4th gear
20. Bearing
21. Countershaft 5th gear (part of countershaft)
22. Countershaft 6th gear (part of countershaft)
23. Mainshaft
24. Bearing
25. Mainshaft 4th gear
26. Mainshaft 3rd gear
27. Mainshaft 2nd gear
28. Mainshaft 1st gear
29. Mainshaft 5th gear
30. Dog ring
31. Guiding hub
32. Retaining ring
33. Retaining ring
34. Main drive gear bearing (2)
35. Main drive gear
36. O-ring
37. Bearing spacer
38. Retaining ring
39. Oil seal

Figure 6-16. Mainshaft and Countershaft Assembly

Countershaft

NOTES

- *If removing countershaft without removing the mainshaft, hold countershaft 3rd and 4th gear shift dog up while pressing countershaft out of side door bearings.*
- *Do not press directly on the end of the countershaft. Place a spacer such as a washer between the end of the countershaft and the press ram.*

1. Press countershaft out of side door bearings.
2. See 6.6 TRANSMISSION ASSEMBLY, Disassembly, Replacing Side Door Bearings for side door bearing replacement.
3. See Figure 6-17. Remove washer (1), countershaft 1st gear (2) and bearing.

NOTE

See Figure 6-18. Note the direction that the 2nd gear locking ring is installed.

4. Remove countershaft 2nd gear lock ring.
5. See Figure 6-19. Remove securing segments (1). Remove dog ring (3), guiding hub (2), countershaft 2nd gear (4) and bearing.

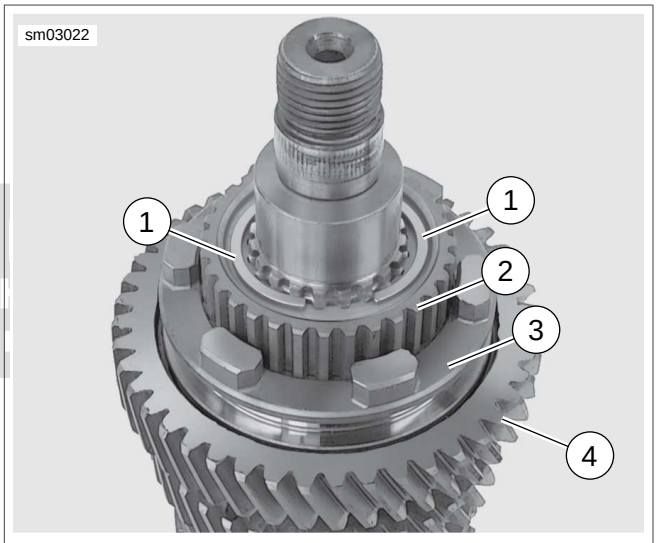


1. **Washer**
2. **Countershaft 1st gear**

Figure 6-17. Countershaft 1st Gear



Figure 6-18. Lock Ring



1. **Securing segment**
2. **Guiding hub**
3. **Dog ring**
4. **Countershaft 2nd gear**

Figure 6-19. Securing Segment

NOTE

See Figure 6-20. Note the direction that the 3nd gear locking ring is installed.

6. Remove countershaft 3rd gear lock ring.
7. See Figure 6-21. Remove securing segments (1), internal spline washer (2), countershaft 3rd gear (3) and bearing.

NOTE

See Figure 6-22. Note the direction that the 4th gear locking ring is installed.

8. Remove 4th gear lock ring (1), securing segments, dog ring (3), guiding hub (2), and countershaft 4th gear (4) and bearing.

NOTE

As countershaft 5th gear and 6th gear are an integral part of the shaft, damage to either gear requires countershaft replacement.

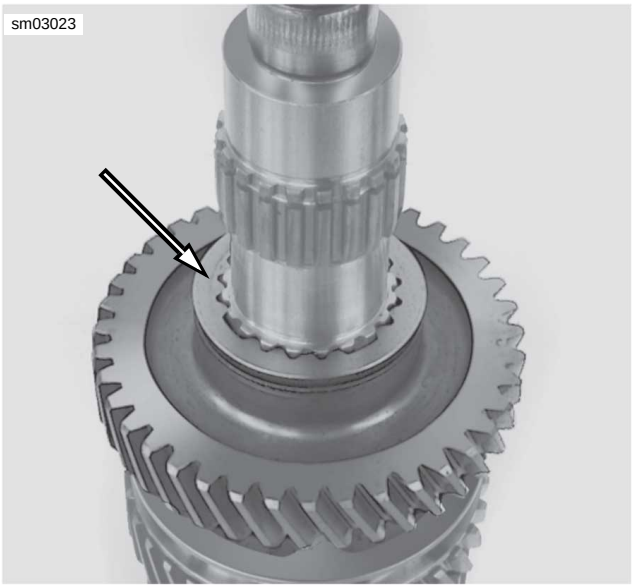
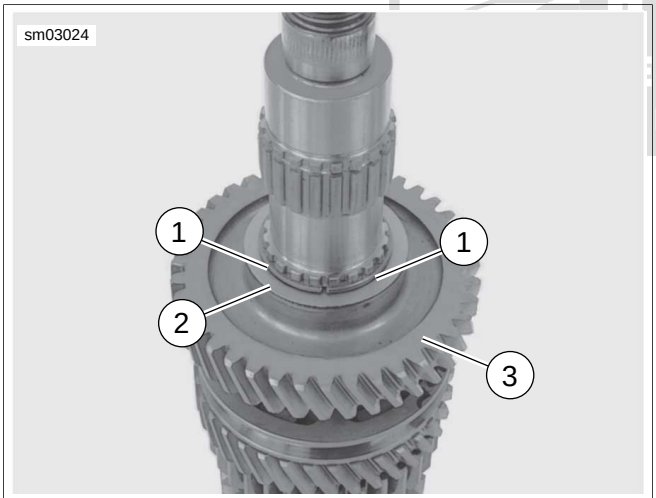
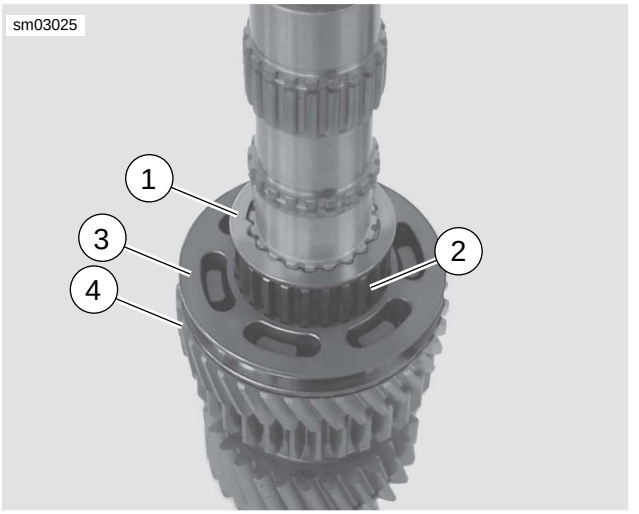


Figure 6-20. Third Gear Lock Ring



1. **Securing segment**
2. **Internal spline washer**
3. **Countershaft 3rd gear**

Figure 6-21. Countershaft Third Gear



1. **4th gear lock ring**
2. **Guiding hub**
3. **Dog ring**
4. **Countershaft 4th gear**

Figure 6-22. Countershaft Assembly

Replacing Side Door Bearings

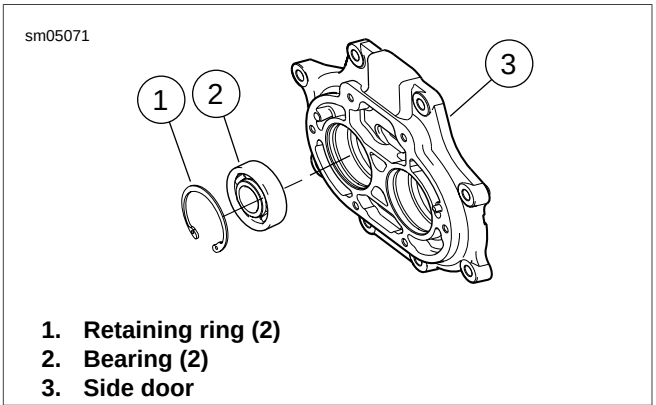
NOTE

Always replace side door bearing if the shaft is pressed out.

WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

1. See Figure 6-23. Remove the retaining rings (2).
2. Press the bearings out of the side door.



1. **Retaining ring (2)**
2. **Bearing (2)**
3. **Side door**

Figure 6-23. Side Door Bearings

CLEANING AND INSPECTION

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

1. Clean all parts with solvent. Blow parts dry with low pressure compressed air.
2. Check gear teeth for damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.
3. Inspect the engaging dogs and pockets on the dog rings. Replace the dog rings if dogs and/or pockets are rounded, battered or chipped.
4. Inspect guiding hubs. Replace guiding hubs if splines are rounded, battered or chipped.
5. Inspect shift fork shafts. Replace if bent or damaged.
6. Inspect shift forks for wear or signs of overheating. Replace a shift fork if it is excessively worn or shows signs of overheating.
7. See Figure 6-24. Using a small carpenter's square, verify the shift forks are square. If shift fork does not rest directly on the square, then it is bent and must be replaced.
8. Inspect shift drum and bearing. Replace shift drum assembly if drum or bearing are damaged.
9. Clean shift cam lock plate mounting holes in transmission bearing housing.
10. Inspect side door bearings. Bearings must rotate freely without drag. Replace the bearings if pitted, grooved or if the shafts were removed.

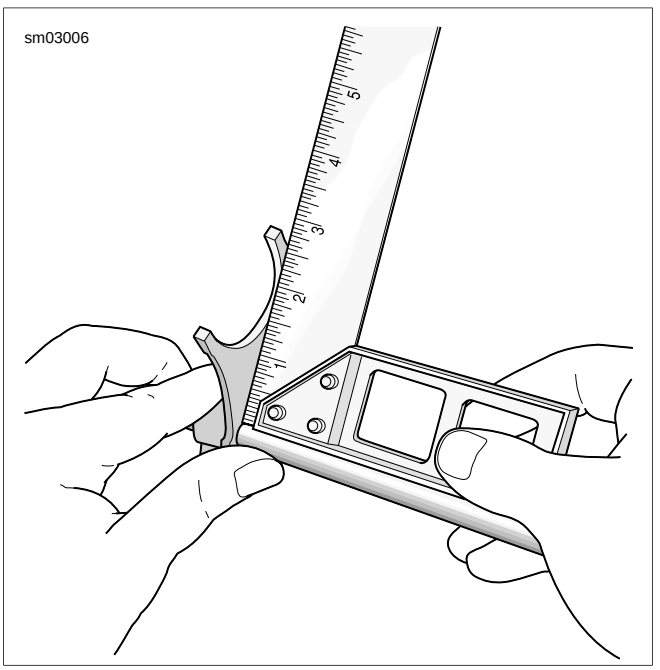


Figure 6-24. Checking Fork

ASSEMBLY

PART NUMBER	TOOL NAME
J-5586A	TRANSMISSION SHAFT RETAINING RING PLIERS

Installing Side Door Bearings

NOTES

- *Always replace side door bearing if the shaft was pressed out.*
- *To perform the next step, you must use a plate for support or the bearing door will be damaged.*
- *When pressing **new** bearings into side door, press on the outside diameter of the bearing side with the numbers stamped on it.*

1. Support the door from the opposite side at the bearing bores with a flat plate.
2. Position **new** bearing over bore with number side UP.
3. Using a press, apply pressure to the outer diameter of the bearing until the bearing is seated in the bore.

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

4. See Figure 6-23. Install beveled retaining ring (1) with the flat side next to the bearing.

Countershaft

NOTES

- *Replace retaining ring and all gear roller bearings with **new** parts during assembly. Lubricate needle bearings and races with clean transmission lubricant before installation.*
- *Install securing segments so the side with the rounded edge is facing up and the side with the straight edge is down. Be sure segments fully engage grooves in countershaft.*
- *One side of the 2nd, 3rd, and 4th gear lock rings have a waved, stepped face. The waved, stepped face always faces the securing segments.*

1. See Figure 6-22. Install **new** needle bearing, countershaft 4th gear (4), guiding hub (2), dog ring (3) securing segments and internal splined washer (1) on countershaft.
2. See Figure 6-21. Install **new** needle bearing, countershaft 3rd gear (3), internal spline washer (2) and securing segments (1).
3. See Figure 6-20. Place countershaft 3rd gear lock ring over securing segments.

NOTES

- *In next step, the side of the guiding hub with the deeper counterbore, faces countershaft 2nd gear.*
- *Countershaft 2nd gear bearing is wider than other bearings on the countershaft.*

4. See Figure 6-19. Install **new** needle bearing, countershaft 2nd gear (4), guiding hub (2), dog ring (3) and securing segments (1) on countershaft.
5. See Figure 6-18. Place lock ring over securing segments with the stepped face of the lock ring against the securing segments.
6. See Figure 6-17. Install **new** needle bearing, countershaft 1st gear (2) and washer (1).

NOTES

- *If installing countershaft only, hold countershaft 3rd and 4th gear shift dog up while pressing side door bearing on to countershaft.*
- *Failure to press on inner bearing races while pressing bearings on the shafts will damage the bearings.*

7. See Figure 6-25. Place countershaft in an arbor press supporting countershaft 6th gear. Using a suitable socket, press on inner bearing race until side door bearing contacts countershaft 1st gear washer.



Figure 6-25. Installing Countershaft

Mainshaft

NOTES

- *Failure to press on inner bearing race while pressing bearing on the shaft will damage the bearing.*
- *See Figure 6-26. Hold dog ring so that it is engaged with countershaft 3rd gear during the press procedure. If press is performed with dog ring engaged with countershaft 4th gear, contact with mainshaft 4th gear will push shafts out of alignment and result in possible bearing and gear damage.*

1. Place mainshaft in an arbor press, supporting mainshaft 4th gear.
2. Place rear side door bearing over mainshaft. Using a suitable socket, press on inner bearing race until side door bearing contacts mainshaft 1st gear.
3. See Figure 6-15. With side door on end (shafts pointing upward), install **new** bearing and mainshaft 5th gear (4).
4. Be sure guiding hub counterbore is facing mainshaft 5th gear and install guiding hub (2) and dog ring (3).
5. Install **new** retaining ring using TRANSMISSION SHAFT RETAINING RING PLIERS (Part No. J-5586A) (1).

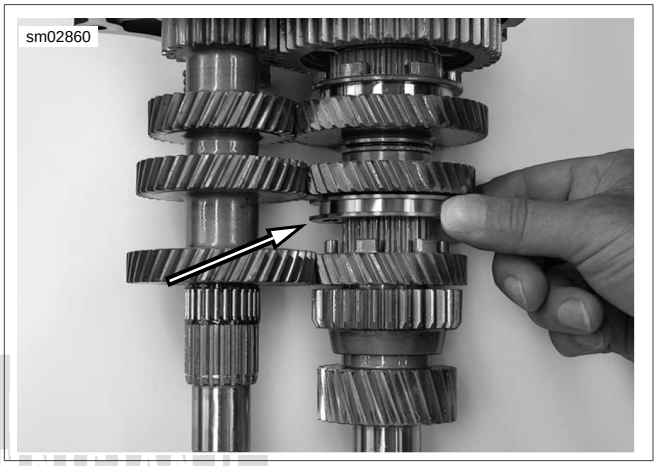


Figure 6-26. Raise and Hold Dog Ring

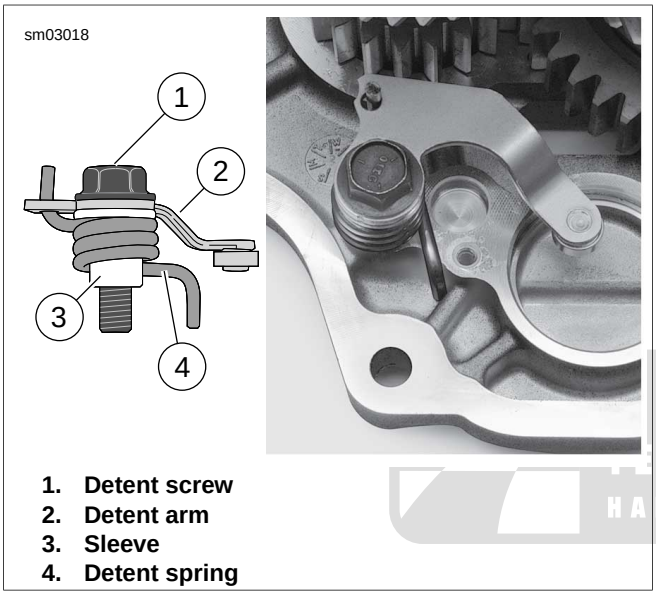
Shifter Cam/Shifter Forks

1. Using dog rings, lock two gears in place. Temporarily place transmission assembly into transmission case.
2. Install **new** nuts on mainshaft and countershaft. Tighten nuts to 55-65 ft-lbs (74.6-88.2 Nm).
3. Remove transmission assembly from case.
4. Place side door on bench with shafts pointing upward.
5. If removed, install detent arm assembly:
 a. See Figure 6-27. Clean detent screw mounting hole in transmission side door.
 b. Assemble **new** detent screw, detent arm, sleeve and detent spring. Mount detent assembly in bearing housing as shown. Make certain to orient spring and detent arm as shown in the figure. Tighten screw to 120-150 **in-lbs** (13.6-17.0 Nm).
6. See Figure 6-28. Using screwdriver (1), pull detent arm back to allow installation of shift cam assembly.
7. Install shift cam assembly (5).
8. See Figure 6-29. Install lock plate (2) and **new** lock plate fasteners (3). Tighten fasteners to 57-63 **in-lbs** (6.4-7.1 Nm).

9. See Figure 6-30. The forks are different from each other and are identified as shown.
10. See Figure 6-31. Insert shifter fork (2) into the slot of the dog ring in between mainshaft 5th and 6th gear. Slide long shift shaft through 5th and 6th gear shifter fork and install shaft in hole in side door.
11. Insert shifter fork (6) into the slot of the dog ring in between countershaft 3rd and 4th gear. Insert shifter fork (9) into the slot of the dog ring in between countershaft 1st and 2nd gear. Slide short shift shaft through countershaft shifter forks and install shaft in hole in side door.

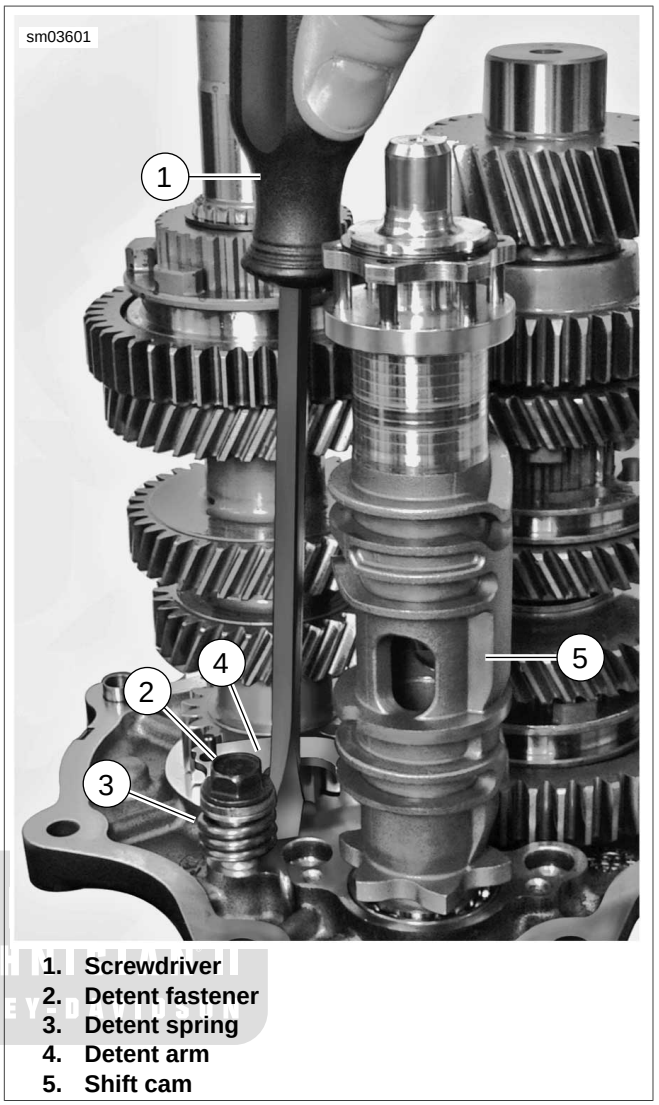
NOTE

If main drive gear was removed, install it now. See 6.7 MAIN DRIVE GEAR AND BEARING.



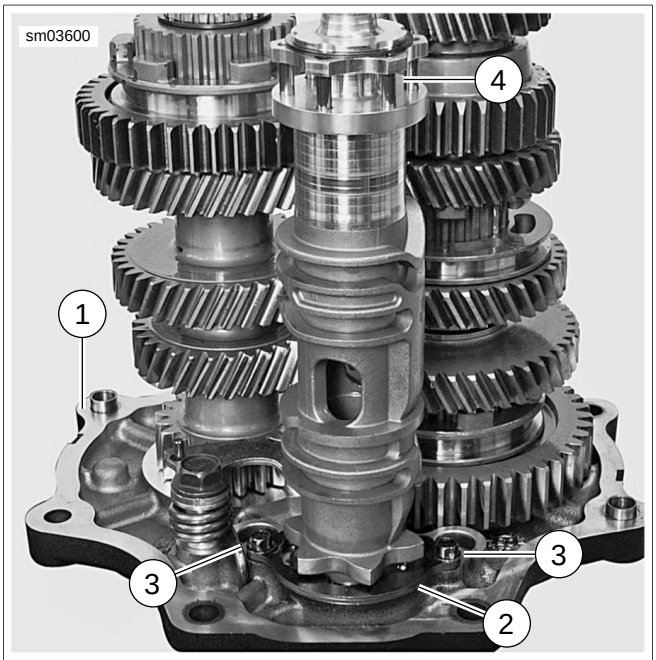
1. **Detent screw**
2. **Detent arm**
3. **Sleeve**
4. **Detent spring**

Figure 6-27. Detent Assembly



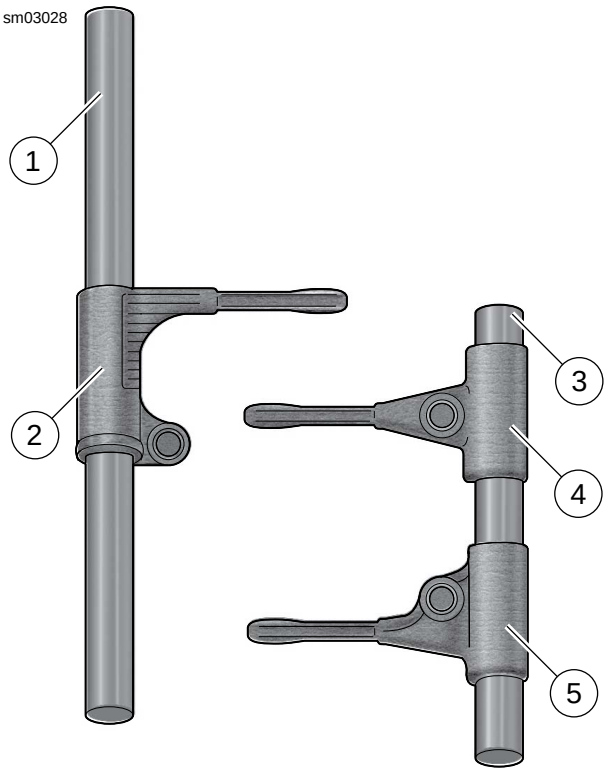
1. **Screwdriver**
2. **Detent fastener**
3. **Detent spring**
4. **Detent arm**
5. **Shift cam**

Figure 6-28. Detent Assembly



1. Side door
2. Lock plate
3. Lock plate fastener (2)
4. Shift cam

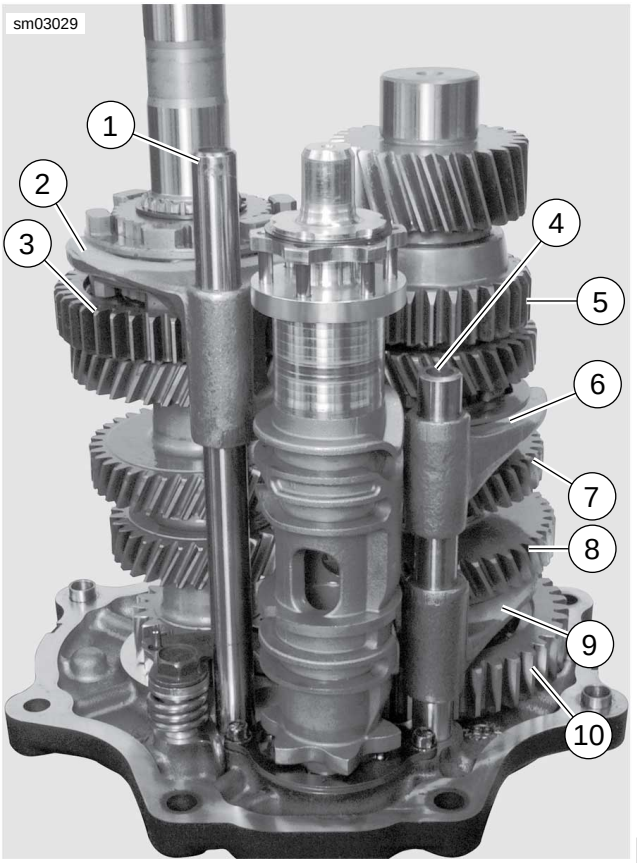
Figure 6-29. Shift Drum



1. Long shift shaft
2. 5th and 6th gear shifter fork
3. Short shift shaft
4. 3rd and 4th gear shifter fork
5. 1st and 2nd gear shifter fork

Figure 6-30. Shifter Forks and Shafts

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1. **Long shift shaft**
2. **5th and 6th gear shifter fork**
3. **5th gear**
4. **Short shift shaft**
5. **4th gear**
6. **3rd and 4th gear shifter fork**
7. **3rd gear**
8. **2nd gear**
9. **1st and 2nd gear shifter fork**
10. **1st gear**

Figure 6-31. Transmission Gears and Shifter Forks

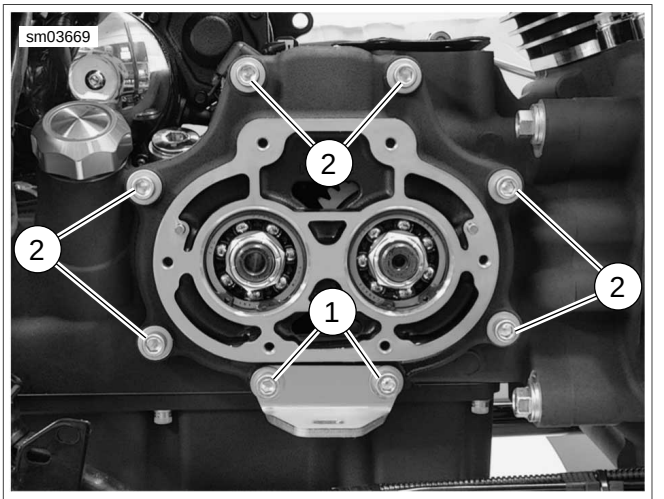
INSTALLATION

1. Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear oil seal.
2. Verify that two ring dowels are in place on side door flange. place a **new** gasket on the ring dowels.
3. Apply clean transmission lubricant to the main drive gear bearings.

NOTE

Be sure the transmission filler plug/dipstick is removed before installing transmission assembly. Contact with the filler plug/dipstick will prevent installation of transmission assembly.

4. Install the transmission assembly in the transmission case with a **new** gasket.
5. See Figure 6-32. Install exhaust bracket using long screws (1). Install remaining side door screws (2).
6. See Figure 6-33. Tighten all side door hardware in the sequence shown to 13-18 ft-lbs (17.6-24.4 Nm).



1. **Long screw (2)**
2. **Short screw (6)**

Figure 6-32. Side Door hardware

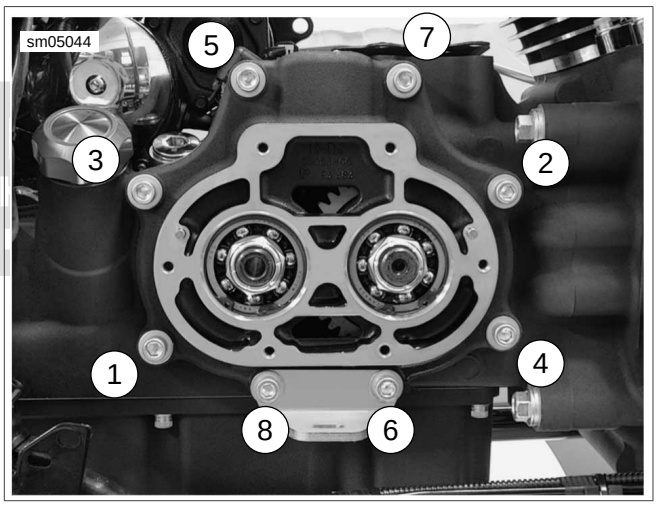
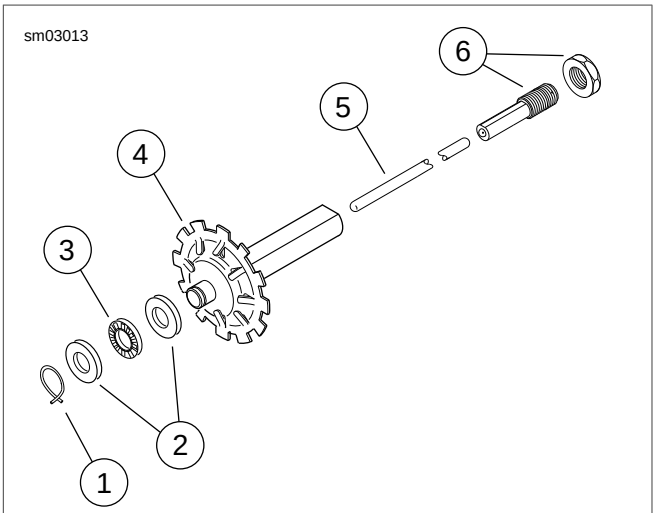


Figure 6-33. Side Door Torque Sequence

7. Install mainshaft bearing inner race. See 5.7 TRANSMISSION SPROCKET.
8. See Figure 6-34. Install push rod assembly (items 2-5) in mainshaft hole. Secure with **new** retaining ring (1) if removed.
9. Install the clutch release cover, using a **new** gasket. See 6.5 CLUTCH RELEASE COVER.
10. Rotate shifter cam pawl forward and lower into place on shift cam. Install **new** transmission top cover gasket. Install transmission top cover. Tighten fasteners to 84-132 **in-lbs** (9.5-14.9 Nm).
11. Install vent hose to top cover fitting, if removed.
12. Install transmission sprocket nut. See 5.7 TRANSMISSION SPROCKET.

13. Install primary chaincase, clutch assembly and primary cover. See 5.3 PRIMARY CHAINCASE COVER, Installation.
14. Replace o-ring on plug. Clean and install transmission drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
15. Fill transmission to proper level with fresh transmission fluid. See 1.8 TRANSMISSION LUBRICANT.
16. Adjust drive belt tension. See 1.13 REAR BELT DEFLECTION.
17. Install exhaust system. See 4.19 EXHAUST SYSTEM.



1. **Retaining ring**
2. **Thrust washer (2)**
3. **Throw out bearing**
4. **Oil slinger**
5. **Push rod**
6. **Push rod end, left side**

Figure 6-34. Push Rod Assembly

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MAIN DRIVE GEAR AND BEARING 6.7

REMOVAL

PART NUMBER	TOOL NAME
HD-35316-10	PILOT
HD-35316-11	RECEIVER CUP
HD-35316-3A	CROSS PLATE
HD-35316-4A	8 IN. BOLT
HD-35316-5	12 IN. BOLT
HD-35316-7	WASHER
HD-35316-9	BEARING DRIVER
HD-35316-C	MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER
HD-95637-10	LONG BOLTS
HD-95637-46B	WEDGE ATTACHMENT
RS-25100-200	NICE BEARING

NOTE

Leave the transmission case in the frame unless the case itself must be replaced. For illustration purposes, some photographs may show the case removed.

1. Remove the exhaust system. See 4.19 EXHAUST SYSTEM.
2. Remove the primary chaincase cover, clutch assembly, primary chain, compensating sprocket, and primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.
3. Remove the bearing inner race from the transmission mainshaft. See 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race.
4. Remove the transmission side door. See 6.6 TRANSMISSION ASSEMBLY.

CAUTION

Failure to use Main Drive Gear Remover and Installer can cause premature failure of bearing and related parts. (00540b)

NOTE

Main drive gear and bearing can be removed with the transmission case in the frame after removing door assembly. Use MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER (Part No. HD-35316-C).

5. Remove retaining ring.

NOTES

- *The main drive gear bearing and retaining ring must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.*
- *The CROSS PLATE (Part No. HD-35316-3A) is stamped, "UP 6 SPEED". Mount cross plate with this end pointing up.*

6. See Figure 6-35. Place CROSS PLATE (Part No. HD-35316-3A) (1) on right side of transmission case as shown, and secure with two screws (2). Position cross plate so that large bolt hole in cross plate is lined up with center of main drive gear (4).
7. Apply a light coat of graphite lubricant to the threads of the 12 IN. BOLT (Part No. HD-35316-5) (3) and insert through cross plate and main drive gear.
8. At left side of transmission case, place WASHER (Part No. HD-35316-7), NICE BEARING (Part No. RS-25100-200) (6), flat washer (7) and nut (8) over end of bolt. Tighten nut until main drive gear is free.

NOTES

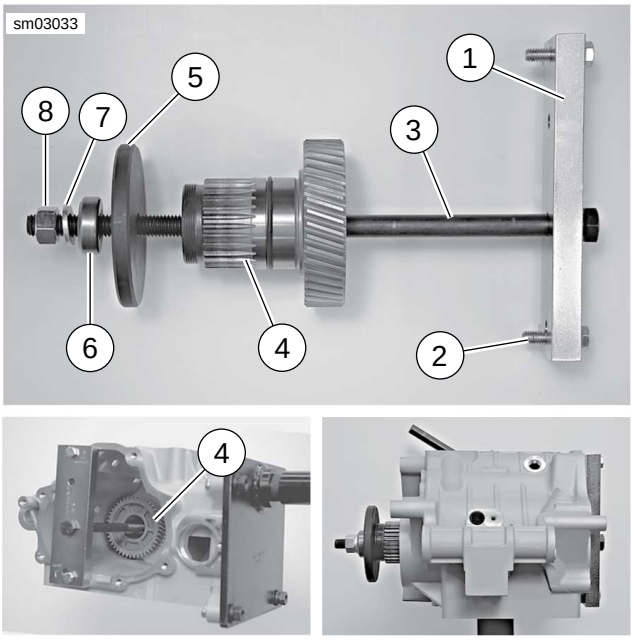
- *When removing the main drive gear, the gear is pressed out against the resistance of the bearing inner race. Without any support at the inner race, the bearing is destroyed. Whenever the main drive gear is removed the main drive gear bearing must also be replaced.*
- *See Figure 6-36. When the main drive gear is removed, a portion of the bearing inner race remains attached to the main drive gear. If the main drive gear is to be re-used, this inner race must be removed first.*

9. Remove tool and remove gear from gearcase.
10. See Figure 6-36. Use WEDGE ATTACHMENT (Part No. HD-95637-46B) and LONG BOLTS (Part No. HD-95637-10) to remove inner race from main drive gear.
11. Remove large main drive gear oil seal.
12. Remove retaining ring from bearing bore.
13. See Figure 6-37. Slide PILOT (Part No. HD-35316-10) (3) over small end of BEARING DRIVER (Part No. HD-35316-9) (2).
14. Apply a light coat of graphite lubricant to the threads of the 8 IN. BOLT (Part No. HD-35316-4A) (1) and insert through bearing driver and pilot.
15. Insert bolt with bearing driver and pilot into right side of transmission case, through main drive gear bearing (4). Make sure bearing driver fits up against main drive gear bearing and pilot is centered in bearing bore.
16. At left side of case, slide RECEIVER CUP (Part No. HD-35316-11) (5) onto bolt and over main drive gear bearing. Install NICE BEARING (Part No. RS-25100-200) (6), flat washer (7) and nut (8) over end of bolt.

NOTE

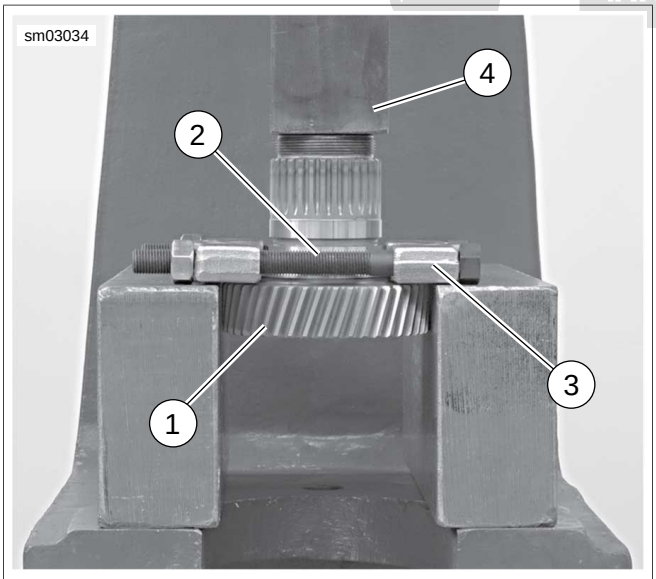
Support bearing remover assembly as you remove bearing in the following step. Entire assembly will fall out of transmission case when bearing comes free.

17. Tighten nut until main drive gear bearing is free.
18. Discard main drive gear bearing.



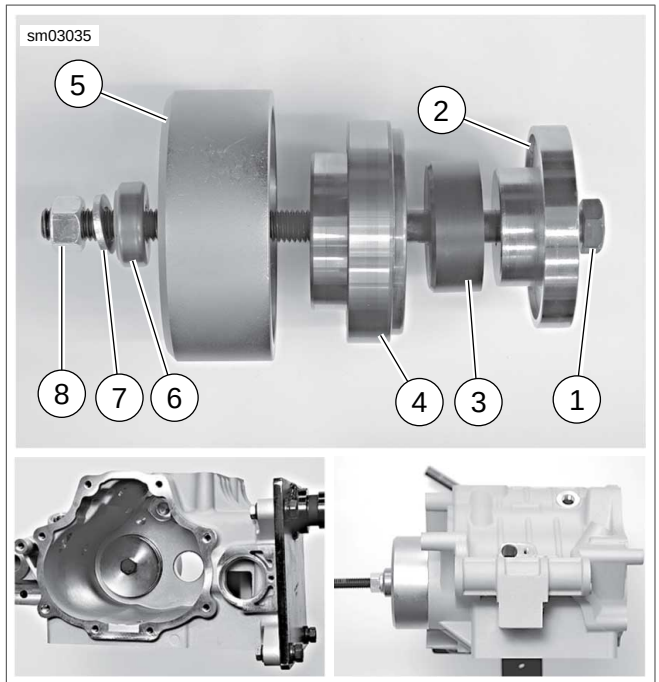
1. Cross plate
2. Screw (2)
3. 12 in. bolt
4. Main drive gear
5. Washer
6. Nice bearing
7. Flat washer
8. Nut

Figure 6-35. Removing Main Drive Gear



1. Main drive gear
2. Long bolt (2)
3. Wedge attachment
4. Press ram

Figure 6-36. Removing Inner Bearing Race From Main Drive Gear



1. 8 in. Bolt
2. Bearing driver
3. Pilot
4. Main drive gear bearing
5. Receiver cup
6. Nice bearing
7. Flat washer
8. Nut

Figure 6-37. Removing Main Drive Gear Bearing

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CLEANING AND INSPECTION

PART NUMBER	TOOL NAME
HD-47932	MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

1. Clean all parts in solvent except the transmission case and needle bearings. Blow dry with compressed air.

NOTE

Never wash the transmission case and needle bearings with solvent unless the needle bearings are to be replaced. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) and leads to bearing failure.

2. Inspect the main drive gear for pitting and wear. Replace if necessary.
3. Inspect the needle bearings inside the main drive gear. Replace the needle bearings if the mainshaft race is pitted or grooved.

4. Replace the sprocket if teeth are cracked or worn. See 5.7 TRANSMISSION SPROCKET, Cleaning and Inspection for more information.

5. Inspect the needle bearings on the inside of the main drive gear. If mainshaft race surface appears pitted or grooved, replace these bearings.

NOTE

If the main drive gear needle bearings and/or seal need to be replaced, continue as follows. Otherwise, proceed to 6.8 TRANSMISSION CASE, Assembly.

Needle Bearing Replacement

WARNING

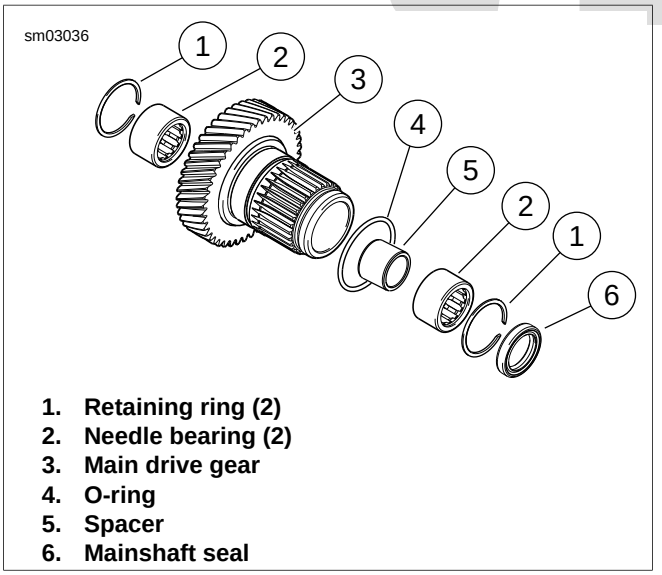
Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

NOTES

- *See Figure 6-39. When replacing needle bearings, discard original retaining rings (1) and install replacement retaining rings (2).*
- *To install the inner main drive gear needle bearings and mainshaft seal, use MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL (Part No. HD-47932).*

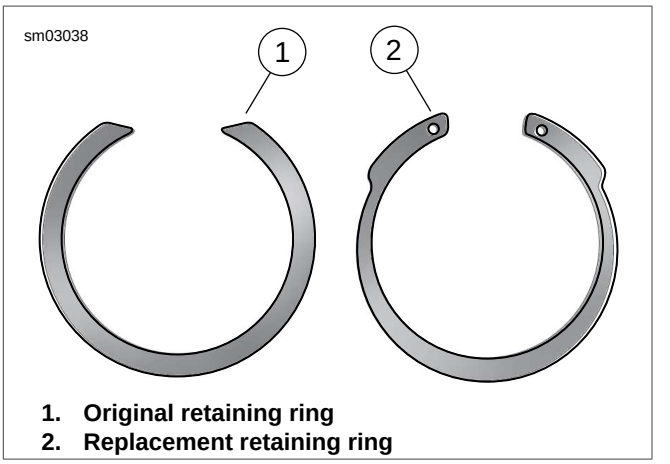
1. See Figure 6-38. Remove mainshaft seal (6). Remove retaining rings (1), needle bearings (2) and spacer (5) from main drive gear (3). Discard retaining rings.

2. Remove and discard o-ring (4).



1. **Retaining ring (2)**
2. **Needle bearing (2)**
3. **Main drive gear**
4. **O-ring**
5. **Spacer**
6. **Mainshaft seal**

Figure 6-38. Main Drive Gear Assembly



1. **Original retaining ring**
2. **Replacement retaining ring**

Figure 6-39. Main Drive Gear Retaining Rings

3. See Figure 6-40. Install clutch side needle bearing using an arbor press and the 0.400 in. step end of tool as shown. Press until tool contacts gear.

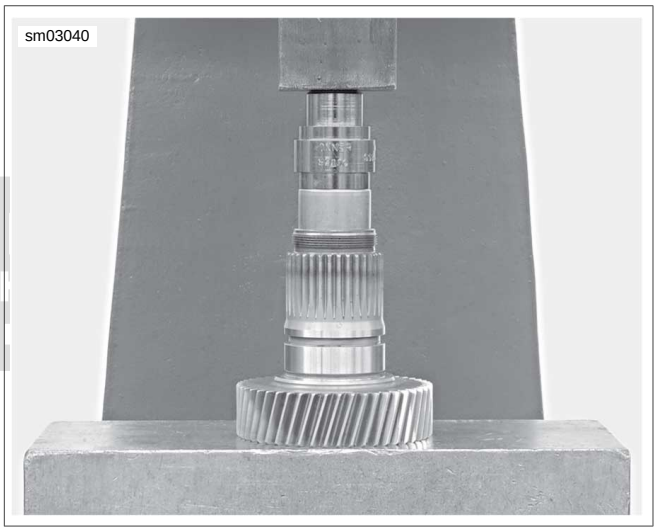


Figure 6-40. Installing Clutch Side Needle Bearing in Main Drive Gear

NOTE

An alternative method is provided which allows the mainshaft seal to be pressed into place after installation of the main drive gear. See 6.7 MAIN DRIVE GEAR AND BEARING, Mainshaft Seal Replacement.

4. See Figure 6-41. Turn over tool and press in mainshaft seal using the 0.090 in. step with garter spring side down.

5. Install spacer.

6. See Figure 6-42. Turn over the main drive gear in the arbor press. With the tool at the 0.188 in. step, press inner bearing until tool contacts gear.

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

7. See Figure 6-38. Install **new** retaining rings (1).
8. Install **new** o-ring (4) into groove in main drive gear.

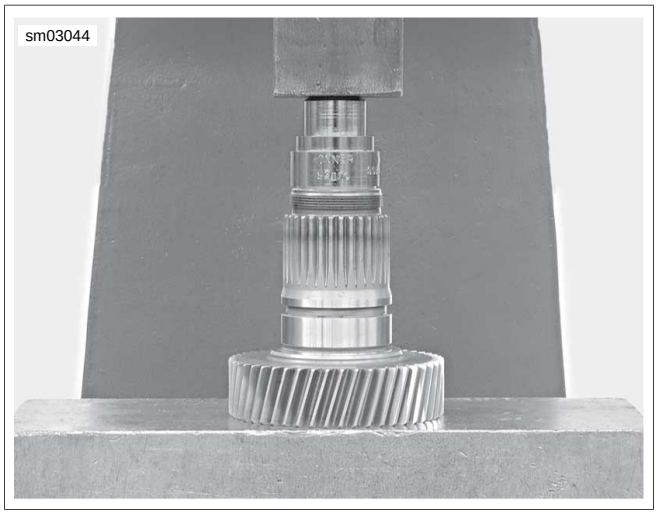


Figure 6-41. Pressing in Seal

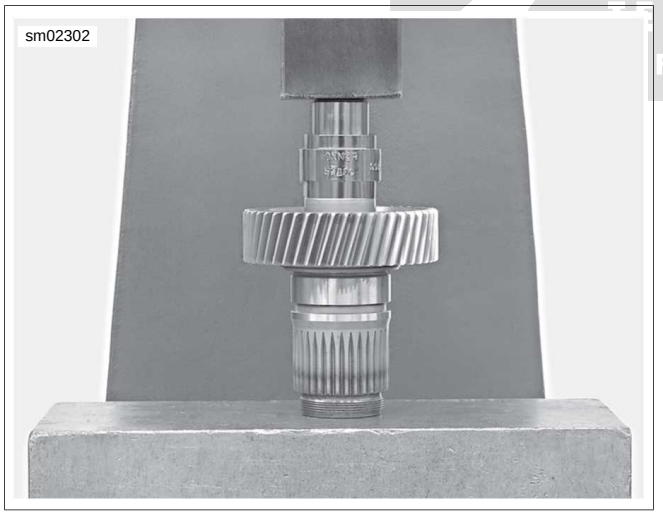
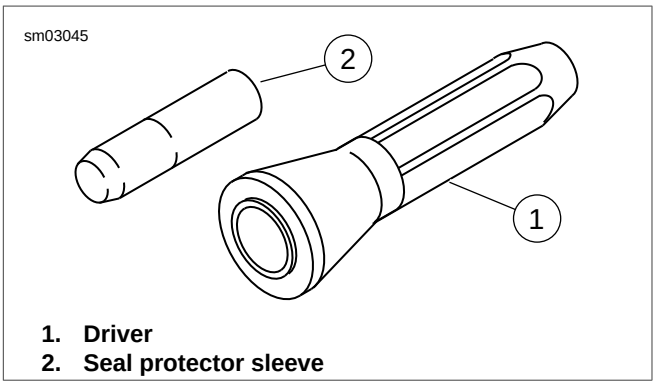


Figure 6-42. Installing Transmission Side Needle Bearing in Main Driver Gear

MAINSHAFT SEAL REPLACEMENT

PART NUMBER	TOOL NAME
HD-47933	MAIN DRIVE GEAR SEAL INSTALLER

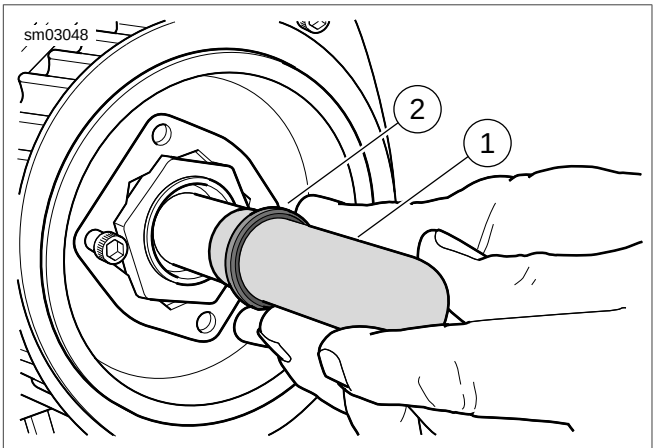
See Figure 6-43. If the mainshaft seal was not installed with the main drive gear needle bearings (or if a faulty seal is discovered with the main drive gear installed in the transmission case), the seal can be installed using the MAIN DRIVE GEAR SEAL INSTALLER (Part No. HD-47933).



1. Driver
2. Seal protector sleeve

Figure 6-43. Main Drive Gear Seal Installer (Part No. HD-47933)

1. Remove the damaged seal using a seal remover or rolling head pry bar.
2. Inspect bore to be sure it is clean and smooth.
3. See Figure 6-44. Place the seal protector sleeve (1) over the end of the mainshaft. Lightly lubricate the protector sleeve and seal ID with clean transmission oil.
4. Verify that the garter spring is in place on the lip of the **new** oil seal. Apply a light coat of H-D 20W-50 engine oil to the seal lip.
5. Squarely seat the mainshaft seal (2) on the seal protector sleeve with the garter spring facing the bearing.
6. See Figure 6-45. Using MAIN DRIVE GEAR SEAL INSTALLER (Part No. HD-47933), hand press seal onto mainshaft and into end of main drive gear. A rubber mallet may be used to lightly tap driver, if necessary. Seal is properly installed when seal driver contacts end of main drive gear.



1. Seal protector sleeve
2. Seal

Figure 6-44. Seal Protector Sleeve

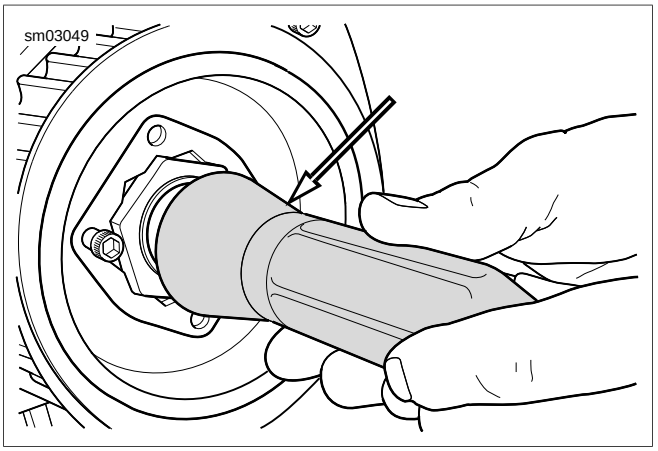


Figure 6-45. Seal Driver

INSTALLATION

PART NUMBER	TOOL NAME
HD-35316-12	INSTALLER CUP
HD-35316-3A	CROSS PLATE
HD-35316-4A	8 IN. BOLT
HD-35316-5	12 IN. BOLT
HD-35316-7	WASHER
HD-35316-8	BEARING DRIVER
HD-47856-1	INSTALLER
HD-47856-2	PILOT
HD-47856-3	ADAPTER
HD-47856-6	NUT
HD-47856-7	CROW'S FOOT WRENCH

CAUTION

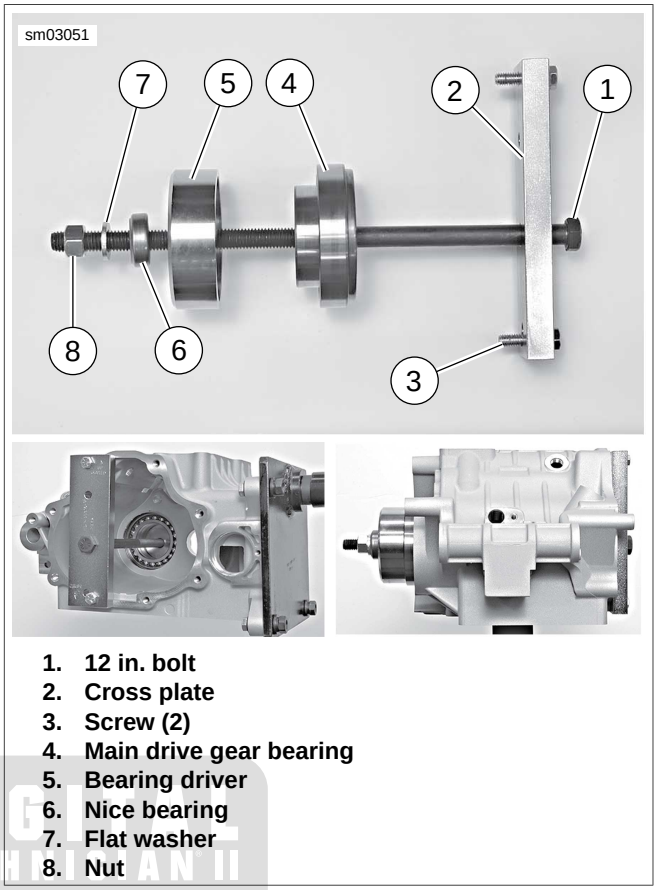
Improper tightening of sprocket nut can cause drive component damage. (00541b)

Installing Main Drive Gear Bearing

NOTE

CROSS PLATE (Part No. HD-35316-3A) will retrofit to earlier transmissions. Note that one end of cross plate is stamped, "UP 6 SPEED". Mount cross plate with this end pointing up for 6 speed transmissions.

1. See Figure 6-46. Place CROSS PLATE (Part No. HD-35316-3A) (2) on right side of transmission case as shown, and secure with two screws (3). Position cross plate so that large bolt hole in cross plate is lined up with center of main drive gear bearing bore in left side of transmission case.
2. Apply a light coat of graphite lubricant to the threads of 12 IN. BOLT (Part No. HD-35316-5) (1) and install through cross plate and main drive gear bearing bore.
3. At left side of case, place main drive gear bearing (4), BEARING DRIVER (Part No. HD-35316-8) (5), NICE BEARING (6), FLAT WASHER (7) and NUT (8) over end of bolt.
4. Tighten nut until main drive gear bearing bottoms against lip cast into transmission case bearing bore.



1. **12 in. bolt**
2. **Cross plate**
3. **Screw (2)**
4. **Main drive gear bearing**
5. **Bearing driver**
6. **Nice bearing**
7. **Flat washer**
8. **Nut**

Figure 6-46. Installing Main Drive Gear Bearing (Typical)

Installing Main Drive Gear

NOTE

*See Figure 6-47. Make sure **new** o-ring (4) is installed onto main drive gear (3). Lubricate o-ring with clean engine oil before installing drive gear into transmission case.*

1. See Figure 6-47. Apply a light coat of graphite lubricant to the threads of 8 IN. BOLT (Part No. HD-35316-4A) (1) and insert through WASHER (Part No. HD-35316-7) (2) and main drive gear (3). Insert assembly into transmission case, through main drive gear bearing.
2. At outside of case, place INSTALLER CUP (Part No. HD-35316-12) (5), NICE BEARING (6), FLAT WASHER (7) and NUT (8) over end of bolt.
3. Tighten nut until main drive gear contacts main drive gear bearing.

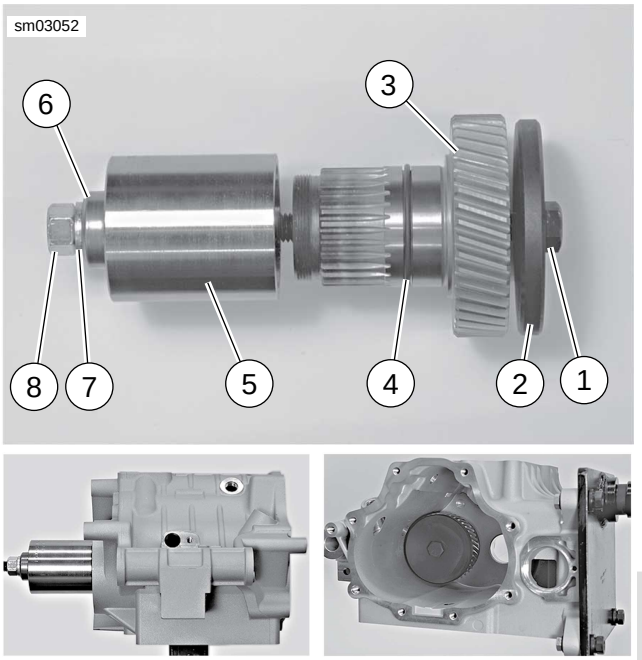
NOTE

See Figure 6-48. In next step, bearing retaining ring must be installed with the flat side facing the bearing and the opening in the ninety degree range shown.

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

4. See Figure 6-49. Install **new** retaining ring (2).



1. **8 in. bolt**
2. **Washer**
3. **Main drive gear**
4. **O-ring**
5. **Installer cup**
6. **Nice bearing**
7. **Flat washer**
8. **Nut**

Figure 6-47. Installing Main Drive Gear (Typical)

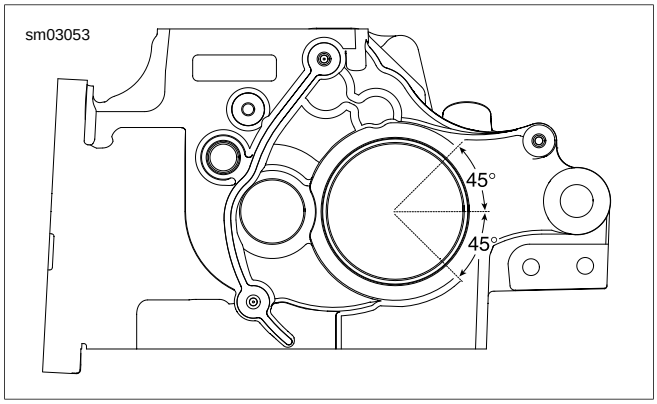


Figure 6-48. Retaining Ring Opening

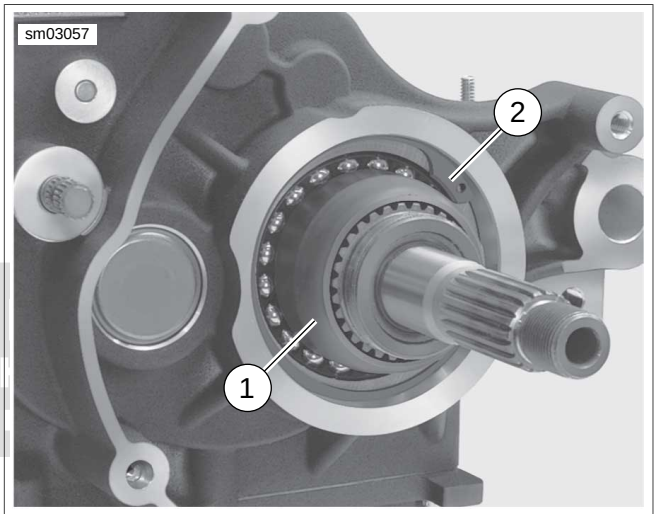
Installing Main Drive Gear Large Seal

1. See Figure 6-49. From outside of crankcase, install PILOT (Part No. HD-47856-2) over end of main drive gear bearing inner race.
2. Coat lips of **new** main drive gear seal with FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt).
3. See Figure 6-50. Place seal over pilot with garter spring facing bearing, and position seal squarely in end of crankcase bore.

NOTE

ADAPTER (Part No. HD-47856-3) and main drive gear have right-hand threads.

4. See Figure 6-51. Thread ADAPTER (Part No. HD-47856-3) onto end of main drive gear until it contacts main drive gear.



1. **Pilot**
2. **Retaining Ring**

Figure 6-49. Install Pilot

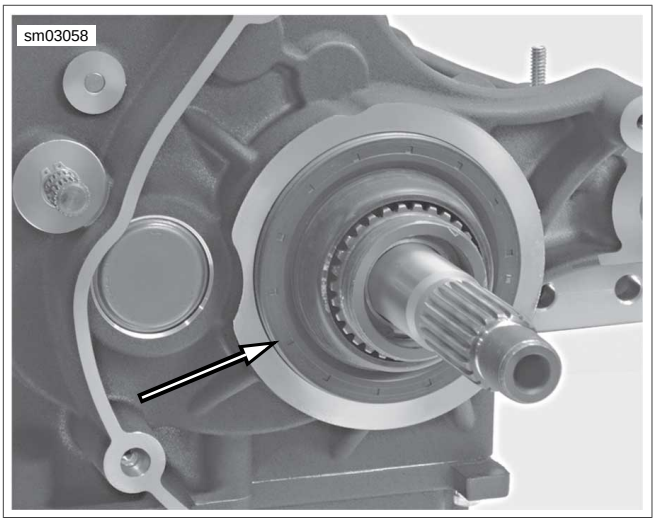


Figure 6-50. Place Main Drive Gear Seal Over Pilot

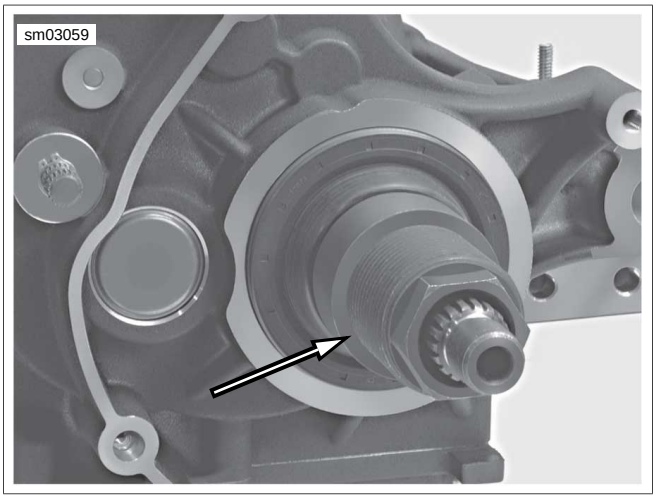


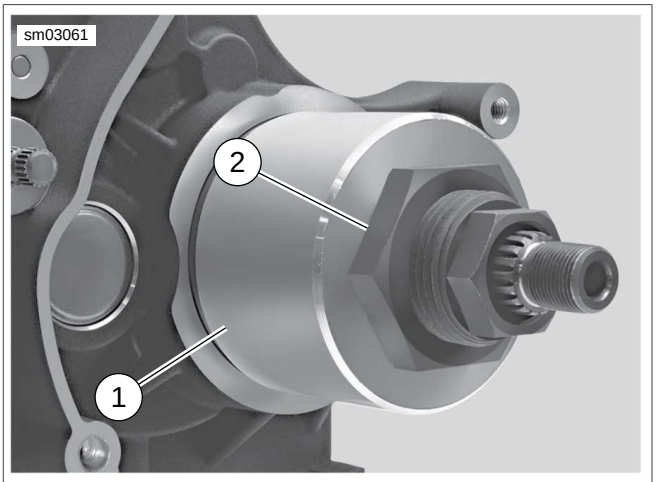
Figure 6-51. Install Adapter

5. See Figure 6-52. Slide INSTALLER (Part No. HD-47856-1) (1) over adapter until cupped end of installer is flat against seal.
6. Thread NUT (Part No. HD-47856-6) (2) onto end of adapter, until it tightens against installer.
7. See Figure 6-53. Place CROW'S FOOT WRENCH (Part No. HD-47856-7) (1) with 1/2 inch drive breaker bar (2) on large nut. Place an adjustable wrench (3) on flats of hex head cast into end of adapter.
8. Holding adjustable wrench, tighten large nut with crow's foot wrench until outer face of seal is flush with outer edge of transmission bore.

NOTE

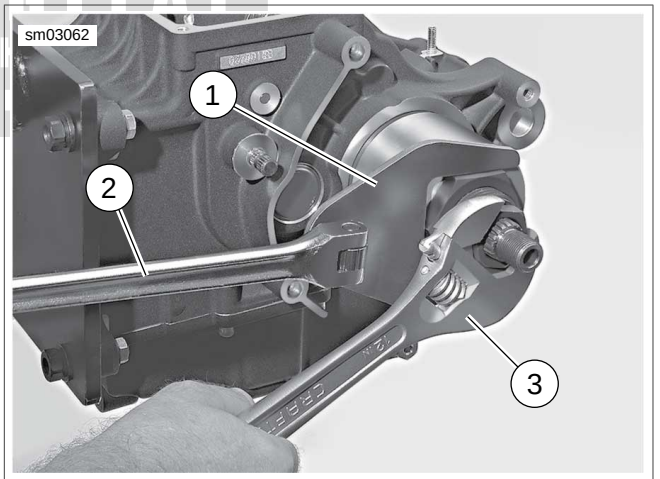
It is acceptable to recess seal as much as 0.030 in. (0.762 mm) below outer edge of bore. Seal depth will be controlled by tool.

9. Remove nut, installer, adapter and pilot.
10. Install side door and transmission components. See 6.6 TRANSMISSION ASSEMBLY, Installation.
11. Install sprocket and drive belt. See 5.7 TRANSMISSION SPROCKET. Do not adjust belt at this time.
12. Install the bearing inner race on the transmission mainshaft. See 6.6 TRANSMISSION ASSEMBLY, Assembly.
13. Install the primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING, Installation.
14. Install the clutch assembly, primary chain, chain tensioner assembly and compensating sprocket components See 5.4 DRIVE COMPONENTS, Installation.
15. Install the primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Installation.
16. Adjust the drive belt. See 1.13 REAR BELT DEFLECTION, Setting Belt Deflection.
17. Install exhaust system. See 4.19 EXHAUST SYSTEM, System Installation.



1. **Installer**
2. **Nut**

Figure 6-52. Installer and Nut



1. **Crow's foot wrench**
2. **1/2 inch breaker bar**
3. **Adjustable wrench**

Figure 6-53. Press Seal Into Crankcase

TRANSMISSION CASE 6.8

REMOVAL

⚠WARNING

Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)

1. Disconnect battery, negative (-) cable first.
2. Drain engine oil. See 1.6 ENGINE OIL AND FILTER, Changing Oil and Oil Filter.
3. Drain transmission lubricant. See 1.8 TRANSMISSION LUBRICANT, Transmission Lubrication.
4. Remove starter. See 7.9 STARTER, Removal.
5. Remove transmission assembly. See 6.6 TRANSMISSION ASSEMBLY, Removal.
6. Remove oil pan. See 3.30 OIL PAN.

CAUTION

When lifting a motorcycle using a jack, be sure jack contacts frame tubes only. Never lift by jacking on crossmembers, oil pan, or other housings. Failure to comply can cause serious damage resulting in the need to perform major repair work. (00586b)

7. Position jack across lower frame to support rear of motorcycle. Slide wooden blocks beneath the crankcase to support the weight of the engine and transmission assembly.
8. Remove rear fork. See 2.24 REAR FORK, Removal.
9. Disconnect vehicle speed sensor (VSS). See 7.23 VEHICLE SPEED SENSOR (VSS), VSS.
10. Disconnect neutral switch. See 7.24 NEUTRAL SWITCH, Removal.
11. Remove fastener from ground post at top of transmission case and remove battery negative ring terminal.
12. Move O2 sensor, starter solenoid, neutral switch and VSS harness out of the way.
13. Mark splines on shift arm and shift shaft to assist in assembly. Remove shift arm from shift shaft.
14. In a crosswise pattern, remove four fasteners that connect transmission to engine.

NOTE

See Figure 6-54. Do not use a hammer to remove transmission. If the transmission sticks or binds on the ring dowels, gently pry away from crankcase using the indent.

15. Move transmission rearward until two ring dowels in lower flange are free of crankcase. Remove transmission case from left side of the motorcycle.

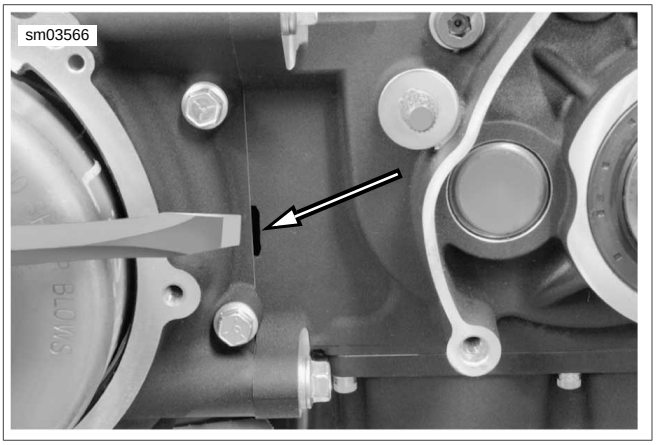


Figure 6-54. Transmission Case Pry Point

INSTALLATION

1. Install **new** ground post at top of transmission case. Tighten ground post until snug.

NOTE

*A **new** transmission case comes with the shifter shaft sleeve and seal, centering screw, countershaft needle bearing and main drive gear bearing and seal installed.*

2. Thoroughly wipe all engine oil from pockets in crankcase flange.
3. Install **new** engine-to-transmission gasket engaging two index pins in holes of transmission flange.
4. Verify that transmission dowels are seated. Place transmission case into position behind crankcase. Mate engine and transmission flanges.
5. Install and tighten fasteners.
 a. Shorter bolts are installed at the top, longer fasteners are installed at the bottom. Using a crosswise pattern, **hand tighten** fasteners.
 b. See Figure 6-55. Tighten bolts in the sequence shown to 15 ft-lbs (20.3 Nm) in the same crosswise pattern.
 c. Final tighten bolts to 34-39 ft-lbs (46.1-52.9 Nm).
6. Install oil pan. See 3.30 OIL PAN.
7. Install rear fork. See 2.24 REAR FORK, Installation.
8. Install shift arm on shift shaft. Align marks made during disassembly.
9. Install transmission and side door assembly. See 6.6 TRANSMISSION ASSEMBLY, Installation.
10. Connect battery ground (-) cable to ground post at top of transmission case. Tighten securely.
11. Adjust drive belt tension. See 1.13 REAR BELT DEFLECTION.
12. Install primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.

13. Install drive components. See 5.4 DRIVE COMPONENTS.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

14. Install primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER.
15. Install neutral switch and tighten to 120-180 **in-lbs** (13.6-20.3 Nm).
16. Install VSS and tighten screw to 84-132 **in-lbs** (9.5-14.9 Nm).
17. Mate VSS, O2 sensors, starter solenoid and neutral switch connectors to main harness.
18. Install starter. See 7.9 STARTER, Installation.
19. Install the exhaust system. See 4.19 EXHAUST SYSTEM.
20. Clean transmission drain plug and install. Tighten to 14-21 ft-lbs (19.0-28.5 Nm). Place motorcycle in an upright position. Fill transmission to proper level with fresh transmission fluid. See 1.8 TRANSMISSION LUBRICANT.

CAUTION

Do not overfill the primary chaincase with lubricant. Overfilling can cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle. (00199b)

21. Fill primary. See 1.7 PRIMARY CHAIN, Chaincase Lubricant.
22. Fill engine oil. See 1.6 ENGINE OIL AND FILTER, Changing Oil and Oil Filter.

WARNING

Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

23. Connect battery cables.

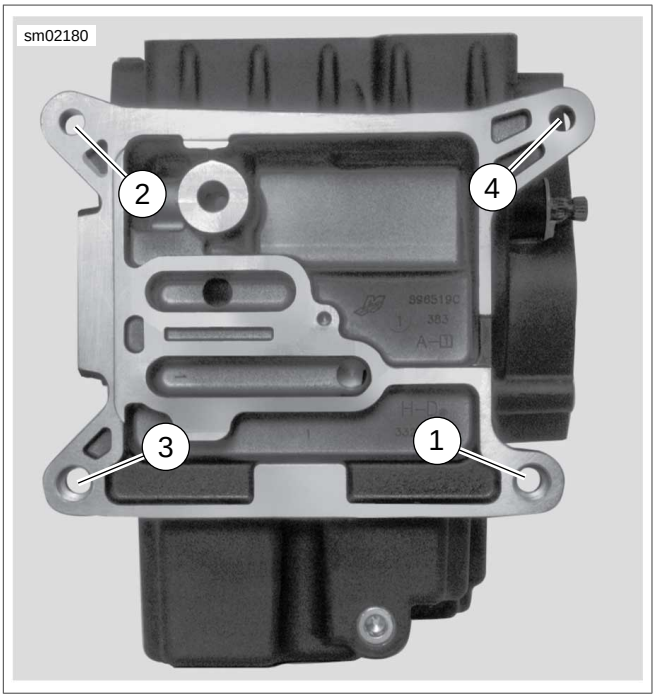


Figure 6-55. Transmission Housing to Crankcase Torque Sequence

DISASSEMBLY

Shifter Arm Assembly

1. See Figure 6-56. After removing door assembly, remove screw (8) and shifter rod lever (9) from the shifter pawl lever assembly (1).
2. Remove retaining ring (7), washer (6) and seal (5). Discard retaining ring and seal. Pull shifter pawl lever assembly out of the transmission case.
3. Inspect sleeve (2) inside transmission case.

CLEANING AND INSPECTION

WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

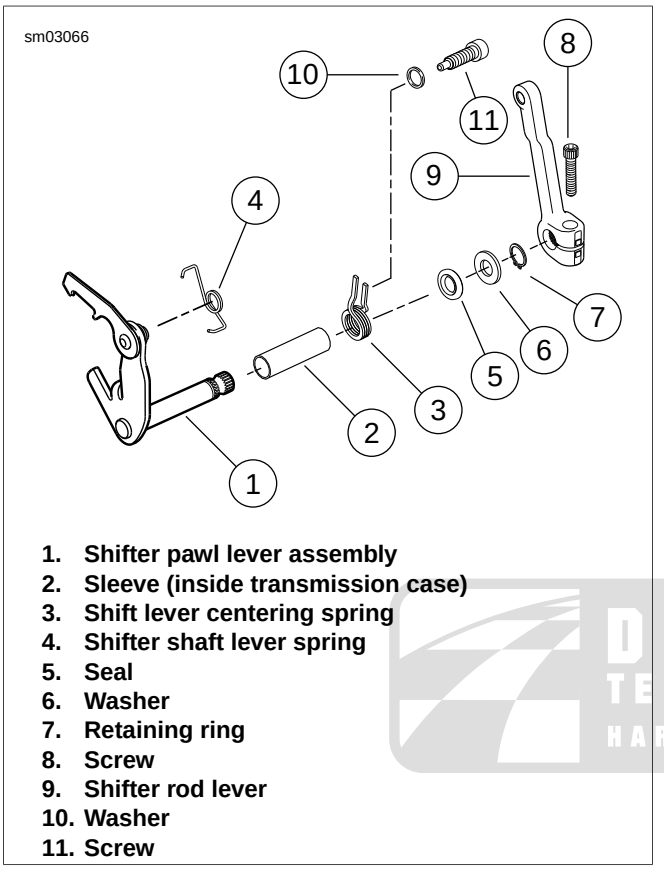
1. Clean all parts in solvent except the case and main drive gear needle bearings. Blow parts dry with low pressure compressed air.

NOTE

Never wash the transmission case and needle bearings with solvent. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) leading to bearing failure.

2. See Figure 6-56. Inspect the shifter pawl lever assembly (1) for wear. Replace assembly if pawl ends are damaged. Replace centering spring (3) if elongated.

3. Inspect the shifter spring (4). Replace if the spring fails to hold the pawl on the cam pins.
4. Thoroughly clean the oil pan with solvent.
5. Inspect preformed transmission top cover vent hose for nicks, cuts or general deterioration. Replace as necessary. Use low-pressure compressed air to verify that hose and fitting are unobstructed.



1. **Shifter pawl lever assembly**
2. **Sleeve (inside transmission case)**
3. **Shift lever centering spring**
4. **Shifter shaft lever spring**
5. **Seal**
6. **Washer**
7. **Retaining ring**
8. **Screw**
9. **Shifter rod lever**
10. **Washer**
11. **Screw**

Figure 6-56. Shifter Arm Assembly

ASSEMBLY

Countershaft Needle Bearing Replacement

1. Find a suitable bearing driver 1.25 in. (31.75 mm) in diameter.
2. From the outside of the transmission case place the needle bearing open end first next to the bearing bore. Hold the driver squarely against the closed end of the bearing and tap the bearing into place. The bearing is properly positioned when it is driven inward flush with the outside surface of the case or to a maximum depth of 0.030 in. (0.76 mm).
3. Lubricate the bearing with transmission lubricant.

Shifter Pawl Lever Assembly

1. See Figure 6-56. Verify that sleeve (2) is inside transmission case.
2. See Figure 6-57. Slide shifter lever centering spring (3) over shaft of shifter pawl lever assembly (2). Align opening on spring with tab on lever.
3. Place shifter shaft lever spring (4) on shifter pawl lever assembly.

NOTE

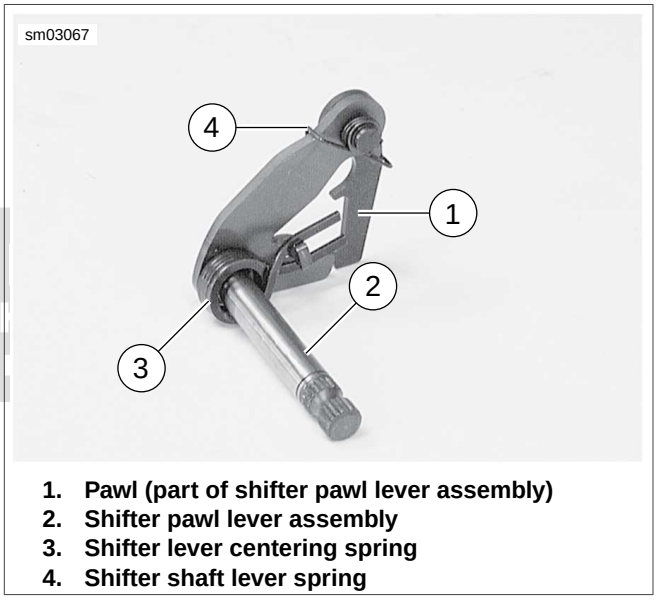
Do not bend shifter shaft lever spring more than necessary for assembly.

4. See Figure 6-58. Insert the assembly into the transmission case.
5. See Figure 6-59. Verify that pin sits inside shifter shaft lever spring.
6. See Figure 6-58. Install a **new** seal. Install washer (1) and a **new** retaining ring (2).

NOTE

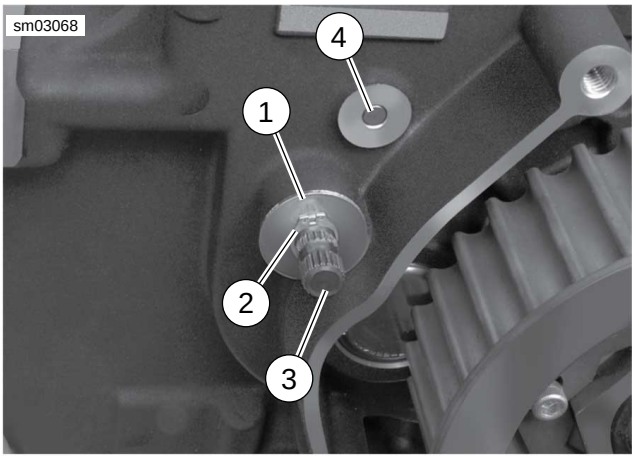
In next step, shifter rod lever must be installed so angle of lever is toward front of vehicle, one spline from vertical.

7. See Figure 6-56. Install shifter rod lever (9) on the shifter pawl lever assembly shaft end using screw (8). Tighten to 18-22 ft-lbs (24.4-29.8 Nm).



1. **Pawl (part of shifter pawl lever assembly)**
2. **Shifter pawl lever assembly**
3. **Shifter lever centering spring**
4. **Shifter shaft lever spring**

Figure 6-57. Shifter Pawl Lever Assembly



1. Washer (with seal behind)
2. Retaining ring
3. Shifter shaft lever
4. Pin

Figure 6-58. Shifter Shaft Lever, Exterior View

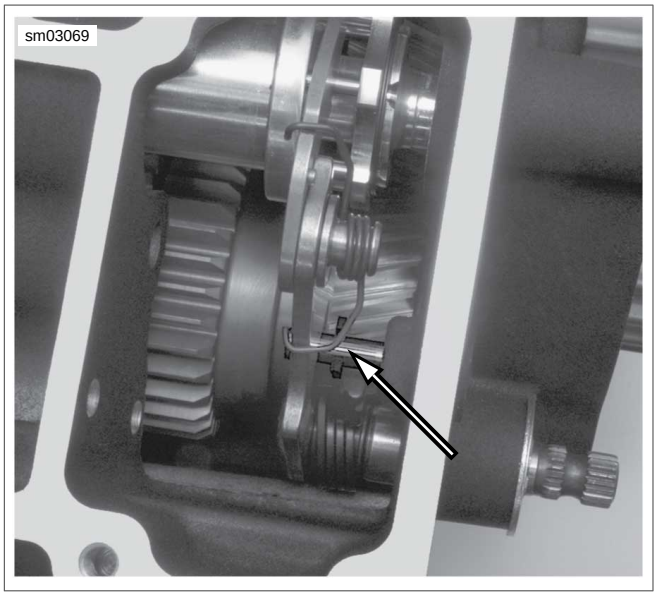


Figure 6-59. Shifter Shaft Lever Spring

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

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NOTES

FASTENER TORQUE VALUES 7.1

FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

FASTENER	TORQUE VALUE		NOTES
2 inch diameter gauge nuts	10-20 **in-lbs**	1.1-2.3 Nm	7.29 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR, 2 Inch Diameter Gauges: Fuel Level, Ambient Air Temperature, Voltmeter, Oil Pressure
Auxiliary lamp bracket to fork bracket screws (FLHT/C/U)	15-20 ft-lbs	20-27 Nm	7.13 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Bracket
Auxiliary lamp bracket to fork bracket stud acorn nuts (FLHR/C)	72-108 **in-lbs**	8.1-12.2 Nm	7.13 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Bracket
Battery terminal bolt	60-70 **in-lbs**	6.8-7.9 Nm	7.9 STARTER, Installation
Battery terminal bolt	60-70 **in-lbs**	6.8-7.9 Nm	7.22 ALTERNATOR, Installation
Battery tray screws	72-96 **in-lbs**	8.1-10.9 Nm	7.7 ELECTRICAL CADDIES, Battery Tray
CB module to radio screw	35-45 **in-lbs**	4.0-5.1 Nm	7.33 ADVANCED AUDIO SYSTEM, Radio (Storage Box)
CB module to radio screw	35-45 **in-lbs**	4.0-5.1 Nm	7.33 ADVANCED AUDIO SYSTEM, CB Module
CKP sensor mount screw	90-120 **in-lbs**	10.2-13.6 Nm	7.21 CRANKSHAFT POSITION SENSOR (CKP), Installation
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	7.31 GAUGES AND INSTRUMENTS: FLHR/C, Speedometer
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	7.32 INDICATOR LAMPS: FLHR/C, Indicator Lamps
Fairing cap screws	25-30 **in-lbs**	2.8-3.4 Nm	7.19 FAIRING CAP SWITCHES: FLHTC/U, Installation
Fairing speaker lower screw (FLHX, FLHTC/U)	22-28 **in-lbs**	2.5-3.2 Nm	7.33 ADVANCED AUDIO SYSTEM, Front Fairing Speakers
Fairing speaker upper screws (FLHX, FLHTC/U)	35-50 **in-lbs**	4.0-5.7 Nm	7.33 ADVANCED AUDIO SYSTEM, Front Fairing Speakers
Fork lock screws (FLHR/C)	36-60 **in-lbs**	4.1-6.8 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHR/C
Front fender tip lamp bracket screws	20-25 **in-lbs**	2.3-2.8 Nm	7.15 FENDER TIP LAMPS, Front Fender Tip Lamp
Front fender tip lamp bracket screws	20-25 **in-lbs**	2.3-2.8 Nm	7.15 FENDER TIP LAMPS, Front Fender Tip Lamp Jumper Harness
Front fender tip lamp trim strip tee bolt nuts	10-15 **in-lbs**	1.1-1.7 Nm	7.15 FENDER TIP LAMPS, Front Fender Tip Lamp Jumper Harness
Front turn signal lamp mounting bracket screws (FLHR/C, FLHT/C/U)	30-60 **in-lbs**	4.1-6.8 Nm	7.16 TURN SIGNAL LAMPS, Front Turn Signal Lamp
Front turn signal lamp mounting bracket screws (FLHX)	15-20 ft-lbs	20-27 Nm	7.16 TURN SIGNAL LAMPS, Front Turn Signal Lamp
Fuel tank console screws	36-60 **in-lbs**	4.1-6.8 Nm	7.33 ADVANCED AUDIO SYSTEM, Front Headset Receptacle
Handlebar clamp to clutch lever bracket screws	72-108 **in-lbs**	8.0-12.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Left Side Handlebar Switches
Handlebar clamp to clutch lever bracket screws	72-108 **in-lbs**	8.0-12.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Installation

FASTENER	TORQUE VALUE		NOTES
Handlebar clamp to master cylinder screws	72-80 **in-lbs**	8.0-9.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Right Side Handlebar Switches
Handlebar clamp to master cylinder screws	72-80 **in-lbs**	8.0-9.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Installation
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Right Side Handlebar Switches
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Left Side Handlebar Switches
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Installation
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Installation
Harness ground stud flange nuts	50-90 **in-lbs**	5.7-10.2 Nm	7.35 MAIN WIRING HARNESS, Installation: All Models (Part 1)/(10 mm)
Harness ground stud flange nuts	50-90 **in-lbs**	5.7-10.2 Nm	7.35 MAIN WIRING HARNESS, Installation: All Models (Part 1)/(10 mm)
Headlamp door screw	9-18 **in-lbs**	1.0-2.0 Nm	7.11 HEADLAMP: ALL EXCEPT FLTR, Headlamp Assembly
Headlamp housing screws (FLHR/C)	9-18 **in-lbs**	1.0-2.0 Nm	7.11 HEADLAMP: ALL EXCEPT FLTR, Headlamp Assembly
Headlamp retaining ring screws (FLXH, FLHT/C/U)	23-28 **in-lbs**	2.6-3.2 Nm	7.11 HEADLAMP: ALL EXCEPT FLTR, Headlamp Assembly
Horn bracket acorn nut	80-120 **in-lbs**	9.0-13.6 Nm	7.27 HORN, Installation
Horn bracket to cylinder head screws	35-40 ft-lbs	48-54 Nm	7.35 MAIN WIRING HARNESS, Installation: All Models (Part 1)
Horn stud flange nut	80-100 **in-lbs**	9.0-11.3 Nm	7.27 HORN, Installation
Ignition coil screws	32-40 **in-lbs**	3.6-4.5 Nm	7.5 IGNITION COIL, Installation
Ignition switch housing nut	125-150 **in-lbs**	14.1-16.9 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR
Ignition switch housing screws	36-60 **in-lbs**	4.1-6.8 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR
Ignition switch screws (FLHR/C)	20-30 **in-lbs**	2.3-3.4 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHR/C
Instrument bezel screws	25-35 **in-lbs**	2.8-4.0 Nm	7.20 INSTRUMENT NACELLE SWITCHES: FLTR, Installation
Instrument console screws	36-60 **in-lbs**	4.1-6.8 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHR/C
Instrument nacelle to fork bracket screws	15-20 ft-lbs	20-27 Nm	7.20 INSTRUMENT NACELLE SWITCHES: FLTR, Installation
Instrument nacelle to fork bracket screws	15-20 ft-lbs	20-27 Nm	7.20 INSTRUMENT NACELLE SWITCHES: FLTR, Installation
Left-side caddy mounting screws	72-96 **in-lbs**	8.1-10.9 Nm	7.7 ELECTRICAL CADDIES, Left Side Caddy
License plate bracket screws	60-80 **in-lbs**	6.8-9.0 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket
License plate bracket screws	60-80 **in-lbs**	6.8-9.0 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket
Long post jam nut	65-80 **in-lbs**	7.3-9.0 Nm	7.10 STARTER SOLENOID, Solenoid Contacts
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm	7.24 NEUTRAL SWITCH, Installation
Oil pressure sender	96-120 **in-lbs**	11-14 Nm	7.25 OIL PRESSURE SWITCH AND SENDER, Installation

FASTENER	TORQUE VALUE		NOTES
Oil pressure switch	96-120 **in-lbs**	11-14 Nm	7.25 OIL PRESSURE SWITCH AND SENDER, Installation
Radio (storage box) to support bracket screws	35-45 **in-lbs**	4.0-5.1 Nm	7.33 ADVANCED AUDIO SYSTEM, Radio (Storage Box)
Radio mounting screw	35-45 **in-lbs**	4.0-5.1 Nm	7.35 MAIN WIRING HARNESS, Installation: FLHX, FLHT/C/U (Part 2)
Radio support bracket screws	35-45 **in-lbs**	4.0-5.1 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR
Rear fender lights harness stud plate flange nuts	60-96 **in-lbs**	6.8-10.9 Nm	7.14 TAIL LAMP, Rear Fender Lights Harness
Rear fender tip lamp screws	20-25 **in-lbs**	2.3-2.8 Nm	7.15 FENDER TIP LAMPS, Rear Fender Tip Lamp
Rear stoplight switch	12-15 ft-lbs	16.3-20.3 Nm	7.26 STOPLIGHT SWITCHES, Rear Stoplight Switch/Use Loctite Pipe Sealant with Teflon 565
Rear turn signal lamps bracket screws	84-144 **in-lbs**	9.5-16.3 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket/Use LOCTITE High Strength Threadlocker 271 (red)
Rear turn signal lamps bracket screws	84-144 **in-lbs**	9.5-16.3 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket/Use LOCTITE High Strength Threadlocker 271 (red)
Rear turn signal lamp to rear turn signal lamps bracket screws	30-50 **in-lbs**	3.4-5.6 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamp
Solenoid ring terminal nut	70-90 **in-lbs**	7.9-10.2 Nm	7.9 STARTER, Field Coil Assembly
Speedometer bracket screws	10-20 **in-lbs**	1.1-2.3 Nm	7.29 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR, Speedometer
Starter end cover screw	90-110 **in-lbs**	10.2-12.4 Nm	7.9 STARTER, Field Coil Assembly
Starter mounting screw	22-24 ft-lbs	29.8-32.5 Nm	7.9 STARTER, Installation
Starter terminal post nut	70-90 **in-lbs**	7.9-10.2 Nm	7.9 STARTER, Installation
Starter thru bolts	39-65 **in-lbs**	4.4-7.3 Nm	7.9 STARTER, Field Coil Assembly
Stator mounting screws	55-75 **in-lbs**	6.2-8.5 Nm	7.22 ALTERNATOR, Installation/Always use new screws
Tachometer bracket screws	10-20 **in-lbs**	1.1-2.3 Nm	7.29 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR, Tachometer
Tail lamp circuit board/chrome base screw	40-48 **in-lbs**	4.5-5.4 Nm	7.14 TAIL LAMP, Circuit Board/Chrome Base
Tail lamp screws	20-24 **in-lbs**	2.3-2.7 Nm	7.14 TAIL LAMP, Tail Lamp/Tail Lamp Bulb
Tail lamp screws	20-24 **in-lbs**	2.3-2.7 Nm	7.14 TAIL LAMP, Circuit Board/Chrome Base
Tail lamp screws	20-24 **in-lbs**	2.3-2.7 Nm	7.14 TAIL LAMP, Rear Fender Lights Harness
Tail lamp screws	20-24 **in-lbs**	2.3-2.7 Nm	7.15 FENDER TIP LAMPS, Rear Fender Tip Lamp
Tail lamp screws	20-24 **in-lbs**	2.3-2.7 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamp
Top caddy clamp screws	72-96 **in-lbs**	8.1-10.9 Nm	7.7 ELECTRICAL CADDIES, Top Caddy
Turn signal lamp fastener: FLHX	15-20 ft-lbs	20-27 Nm	7.16 TURN SIGNAL LAMPS, Front Turn Signal Lamp
Turn signal lamp to auxiliary lamp bracket mount socket screws	36-60 **in-lbs**	4.1-6.8 Nm	7.13 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Housing
Turn signal lamp to auxiliary lamp stud locknut	15-18 ft-lbs	20.3-24.4 Nm	7.13 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Housing
Voltage regulator locknuts	70-100 **in-lbs**	7.9-11.3 Nm	7.3 VOLTAGE REGULATOR, Installation
VSS Screw	84-132 **in-lbs**	9.5-14.9 Nm	7.23 VEHICLE SPEED SENSOR (VSS), VSS

SPECIFICATIONS: ELECTRICAL 7.2

SPECIFICATIONS

Table 7-1. Ignition

IGNITION	DATA
Idle speed	1000 ± 50 RPM
Spark plug size	12 mm
Spark plug gap	0.038-0.043 in.
	0.97-1.09 mm
Spark plug type	Harley-Davidson No. 6R12 (no substitute)
Ignition coil primary resistance	0.5-0.7 ohms
Ignition coil secondary resistance	5500-7500 ohms

Table 7-2. Fuses

FUSE	AMPS
Main fuse	40
Brakes	15
Accessory	15
P&A	15
Radio power/siren	15
ECM power	15
Ignition	15
Engine control: active exhaust (HDI only)	15
Lighting	15
Instruments	15
Headlamp	15
ABS	30
P&A ignition	2
Fuel pump	15
Battery	15
Radio memory	15

Table 7-3. Charging System

CHARGING SYSTEM	DATA
Battery	19 amp hour/270 CCA
Alternator AC voltage output	16-23 VAC per 1000 RPM
Alternator stator coil resistance	0.1-0.2 ohms
Regulator voltage output @ 3600 RPM	14.3-14.7 @ 75° F (24° C)
Regulator amperes @ 3000 RPM	35-50 amps

Table 7-4. Starter Specifications

STARTER DATA	
Free speed	3000 RPM (min.) @ 11.5 V
Free current	90 amp (max.) @ 11.5 V
Cranking current	200 amp (max.) @ 68°F
Stall torque	8.0 ft-lbs (10.8 Nm) @ 2.4 V

Table 7-5. Starter Service Wear Limits

ITEM	IN.	MM.
Brush length (minimum)	0.443	11.0
Commutator runout	0.016	0.41
Commutator diameter (minimum)	1.141	28.98
Commutator mica depth (minimum)	0.008	0.203

NOTE

The fuse labeled Security provides basic turn signal functionality on vehicles without a factory-installed security system. Do not remove this fuse or use it as a replacement fuse for other systems.

VOLTAGE REGULATOR 7.3

REMOVAL

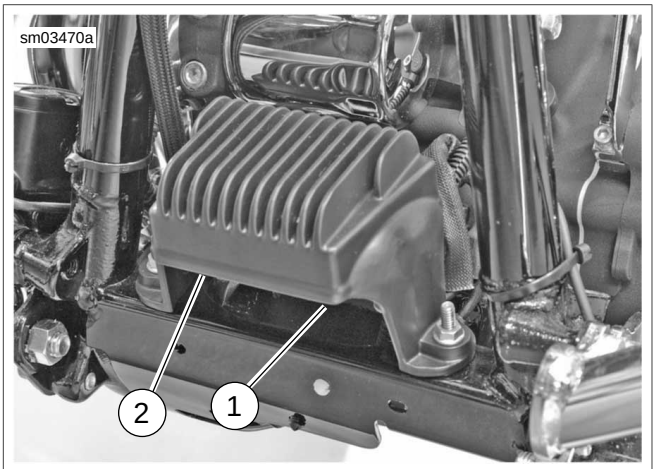
1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Remove locknuts from studs on lower frame crossmember. Lift voltage regulator off studs. Allow voltage regulator to hang upside down at front of lower frame crossmember.
3. See Figure 7-2. Pull away locking latch and remove socket of voltage regulator connector [77] (2).
4. Pull away locking latch and remove socket of stator connector [46] (1).

NOTE

The rubber molded voltage regulator and stator connectors are not serviceable. Damage to terminals, molding or locking latches requires voltage regulator and/or stator replacement.

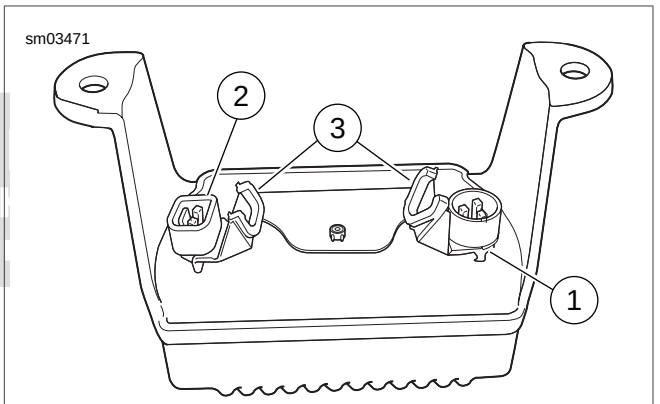
INSTALLATION

1. See Figure 7-2. Install stator connector [46] (1). Secure connector with locking latch (3).
2. Install voltage regulator connector [77] (2). Secure connector with locking latch (3).
3. See Figure 7-1. Install voltage regulator with locknuts on studs and tighten to 70-100 **in-lbs** (7.9-11.3 Nm).
4. Make sure wires are properly secured.
5. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
6. Load test charging system.



1. Stator connector [46]
2. Voltage regulator output connector [77]

Figure 7-1. Voltage Regulator (Left Side View)



1. Stator [46A]
2. Voltage regulator [77A]
3. Locking latch

Figure 7-2. Voltage Regulator (Bottom View)

ELECTRONIC CONTROL MODULE (ECM) 7.4

ECM

Removal

1. Remove seat. See 2.28 SEAT.
2. Pushing rear catch away, lift up ECM until free of top caddy.
3. Disconnect ECM connector [78] as follows:
 a. While depressing button on socket housing, rotate locking bar until seated in the rearward position (index pin on locking bar engages rear notch in socket housing).

 NOTE

 Internal latches are not fully disengaged until locking bar is seated in the rearward position. Forcing socket housing with latches partially engaged will result in connector damage.

 b. Gently pull apart pin and socket housings.

Installation

1. Connect ECM connector [78] as follows:
 a. Verify that locking bar is seated in the rearward position (index pin on locking bar engages rear notch in socket housing).
 b. Aligning large ground pin (73) with blue socket, mate pin and socket housings.

 NOTE

 If pin and socket housings are not properly aligned during the installation attempt, damage to large ground pin (73) will likely occur. Damage to pin requires ECM replacement.

 c. Rotate locking bar until seated in the forward position (index pin on locking bar engages front notch in socket housing).

 NOTE

 Pin and socket housings must be fully engaged before locking bar is rotated to the forward position. Forcing locking bar without full engagement will result in connector damage.

2. Place ECM in approximate position on top caddy (oriented to the right of the left side stop and rear of the front catch).
3. Push ECM forward until front catch engages, and then push down on rear of ECM to engage rear catch.
4. Slide ECM toward left side stop until holes engage two index pins on right side of top caddy.
5. Install seat. See 2.28 SEAT.

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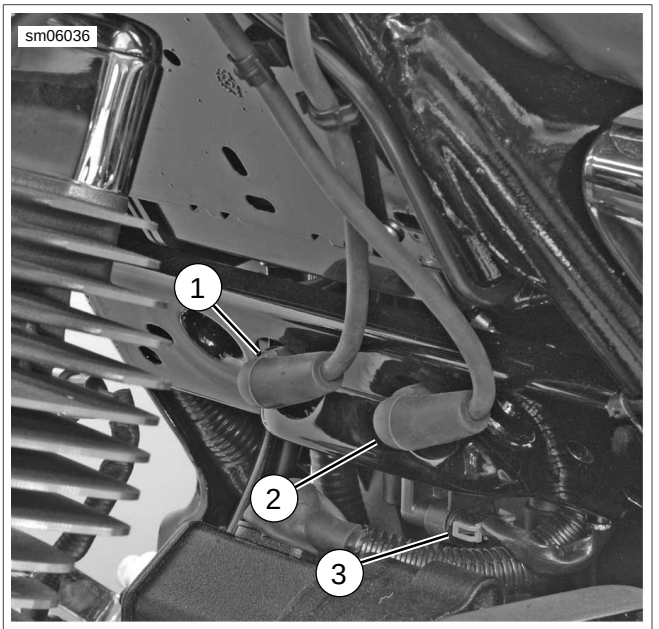
IGNITION COIL 7.5

REMOVAL

1. Remove battery. See 1.17 BATTERY MAINTENANCE.
2. See Figure 7-3. Unplug rear and front spark plug wires (1, 2) from ignition coil.
3. Remove ignition coil connector [83] (3).
4. See Figure 7-4. Remove screws (2) and battery hold-down bracket (3).
5. Loosen ground terminal nut (4). While holding ground terminal wires out of the way, remove ignition coil (1).

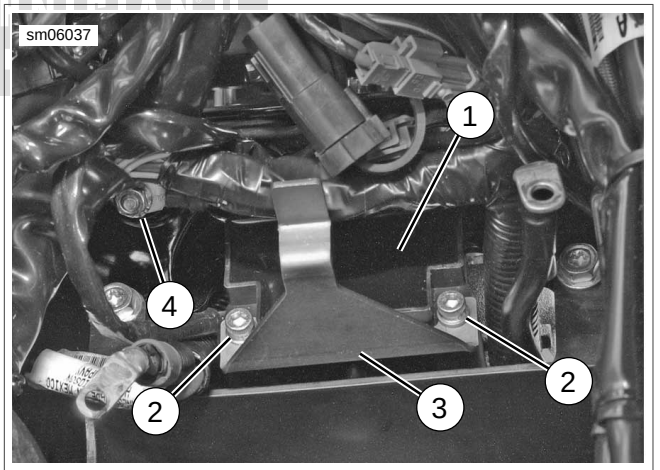
INSTALLATION

1. See Figure 7-4. While holding ground terminal wires out of the way, place ignition coil (1) into position.
2. Install battery hold-down bracket (3) and screws (2). Tighten screws to 32-40 **in-lbs** (3.6-4.5 Nm).
3. Place ground terminal wires in proper position and tighten nut (4).
4. See Figure 7-3. Install ignition coil connector [83] (3).
5. Connect rear (1) and front (2) spark plug wires to ignition coil.
6. Install battery. See 1.17 BATTERY MAINTENANCE.



1. **Rear spark plug wire**
2. **Front spark plug wire**
3. **Ignition coil connector [83]**

Figure 7-3. Spark Plug Wires



1. **Ignition coil**
2. **Screw (2)**
3. **Battery hold-down bracket**
4. **Ground terminal nut**

Figure 7-4. Ignition Coil

SYSTEM FUSES AND RELAYS 7.6

MAIN FUSE

Removal

1. Remove left side saddlebag. See 2.29 SADDLEBAGS.
2. Remove left side cover.
3. See Figure 7-5. Pull main fuse from main fuse holder.

Installation

1. See Figure 7-5. Insert main fuse into main fuse holder.
2. Install left side cover.
3. Install left side saddlebag. See 2.29 SADDLEBAGS.

MAIN FUSE HOLDER

Removal

1. Remove left side saddlebag. See 2.29 SADDLEBAGS.
2. Remove left side cover.
3. Pull main fuse from fuse holder.
4. Remove battery. See 1.17 BATTERY MAINTENANCE.
5. Inboard of left side caddy:
 a. Cut front cable strap to release main harness bundle and main power cable (to main fuse holder). Remove and discard cable strap.
 b. Push up on tongue at bottom of harness cover to release from slot in caddy, and then rotate up and disengage hinges.
 c. Press latches on main fuse holder and pull from hole in caddy.

NOTE

If further disassembly of the left side caddy is necessary, see 7.7 ELECTRICAL CADDIES.

6. Remove socket terminals from main fuse holder. See A.4 DELPHI MAIN FUSE HOUSING.

Installation

1. Install socket terminals into main fuse holder. See A.4 DELPHI MAIN FUSE HOUSING.
2. Inboard of left side caddy:
 a. Push main fuse holder into hole until it locks in place.
 b. Install **new** cable strap through front slot in caddy capturing main harness bundle and main power cable (to main fuse holder).
 c. Engage hinges and rotate harness cover down over main harness bundle. Push up on tongue at bottom of cover to engage slot in caddy.

NOTE

If further assembly of the left side caddy is necessary, see 7.7 ELECTRICAL CADDIES.

3. Install battery. See 1.17 BATTERY MAINTENANCE.
4. Insert main fuse into main fuse holder.
5. Install left side cover.
6. Install left side saddlebag. See 2.29 SADDLEBAGS.

SYSTEM FUSES AND RELAYS

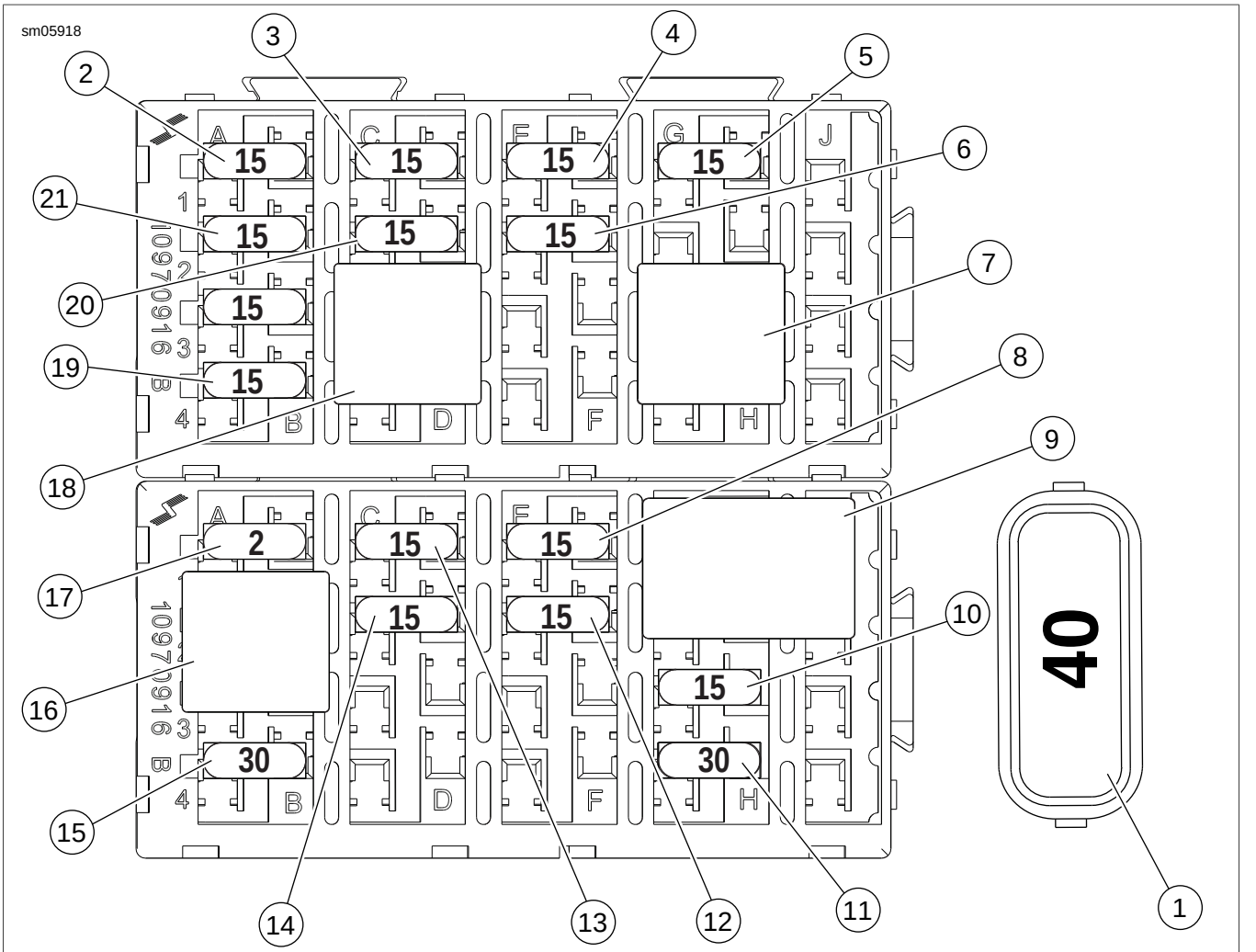
Removal

1. Remove left side saddlebag. See 2.29 SADDLEBAGS.
2. Remove left side cover.
3. Pull main fuse from fuse holder.
4. Push up on tongue at bottom of fuse block cover to release from slot in caddy, and then rotate up and disengage hinge.
5. See Figure 7-5. Remove system fuse/relay from fuse block. Replace fuse if the element is burned. Automotive type ATO fuses are used.

Installation

1. See Figure 7-5. Install system fuse/relay in fuse block.
2. Engage hinge and rotate fuse block cover down over fuse blocks. Push up on tongue at bottom of cover to engage slot in caddy.
3. Insert main fuse into fuse holder.
4. Install left side cover.
5. Install left side saddlebag. See 2.29 SADDLEBAGS.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON®



1. **Main fuse**
2. **Brakes**
3. **Accessory**
4. **P&A**
5. **Radio/siren (if equipped)**
6. **ECM power**
7. **Starter relay**
8. **Ignition**
9. **Lighting relay**
10. **Spare**
11. **Spare**
12. **Lighting**
13. **Instruments**
14. **Headlamp**
15. **ABS (if equipped)**
16. **Brake lamp relay**
17. **P&A ignition (if used)**
18. **EFI system relay**
19. **Fuel pump**
20. **Battery**
21. **Radio memory (if equipped)**

Figure 7-5. Fuse Blocks

FUSE BLOCKS

Removal

1. Remove left side caddy as necessary to release fuse blocks. See 7.7 ELECTRICAL CADDIES.
2. Remove system fuses and relays from fuse blocks.
3. Remove socket terminals from fuse blocks. See A.11 PACKARD 280 METRI-PACK RELAY AND FUSE BLOCK CONNECTORS.

Installation

1. Install socket terminals into fuse blocks. See A.11 PACKARD 280 METRI-PACK RELAY AND FUSE BLOCK CONNECTORS.
2. See Figure 7-5. Install system fuses and relays into fuse blocks.
3. Install fuse blocks into left side caddy. Install left side caddy. See 7.7 ELECTRICAL CADDIES.

ELECTRICAL CADDIES 7.7

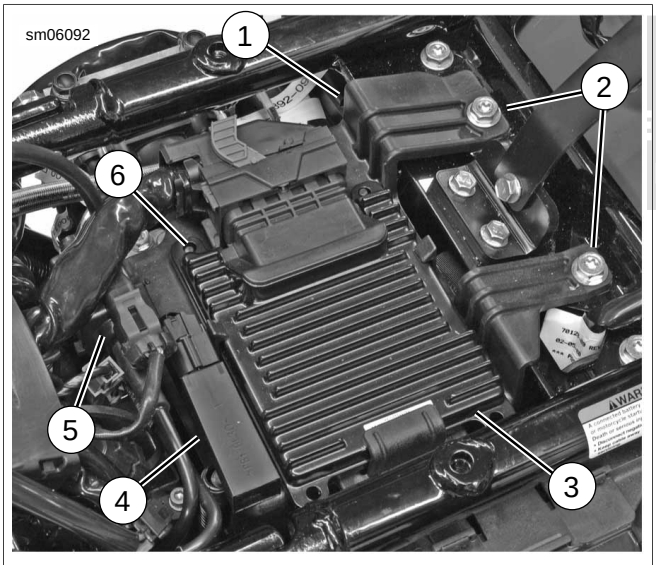
TOP CADDY

Removal

1. Remove seat. See 2.28 SEAT.
2. See Figure 7-6. Remove HFSM antenna (4), if present.
3. Lift up on ECM (3) until free of caddy.
4. Remove screws (2).
5. Lift up on top caddy and slide purge valve solenoid (5) from front caddy, if present. Remove front caddy.

Installation

1. See Figure 7-6. Install purge valve solenoid (5) on front caddy (1) and place caddy into position over battery.
2. Install both screws (2). Tighten screws to 72-96 **in-lbs** (8.1-10.9 Nm).
3. Install ECM (3). Make sure holes in ECM are positioned over alignment pins (6).
4. Install HFSM antenna (4) onto caddy, if present.
5. Install seat. See 2.28 SEAT.



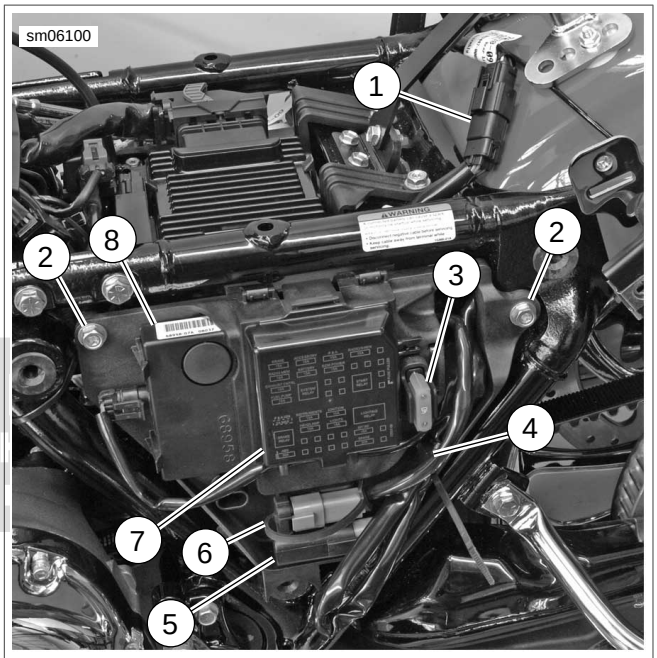
1. **Front caddy**
2. **Screw (2)**
3. **ECM**
4. **HFSM antenna**
5. **Purge valve solenoid**
6. **Alignment pin (2)**

Figure 7-6. Top Caddy

LEFT SIDE CADDY

Removal

1. Remove left side saddlebag. See 2.29 SADDLEBAGS.
2. Remove left side cover.
3. Remove seat. See 2.28 SEAT.
4. See Figure 7-7. Remove main fuse (3).
5. Disconnect rear fender lights harness connector (1) and slide connector body off of mounting tab.
6. Cut cable strap (4) securing excess wire loop for AM/FM antenna, if used.
7. Disconnect siren (8), if installed, and remove from caddy.
8. Remove ABS diode pack (5), if installed, date link connector (6), and fuse block cover (7) from caddy.
9. Remove screws (2).



1. **Rear fender lights harness**
2. **Screw (2)**
3. **Main fuse**
4. **Cable tie**
5. **ABS diode pack**
6. **Data link connector**
7. **Fuse block cover**
8. **Siren**

Figure 7-7. Caddy Components

10. See Figure 7-8. Remove front and rear cable straps (1, 4).
11. Remove harness cover (11).
12. Remove wires from square shaped opening (9).
13. From back side of caddy, squeeze tabs at top and bottom of main fuse holder (15) and pull away from left-side caddy.
14. On back side of caddy, pull tabs holding fuse block (13) to caddy and remove fuse block from back side of caddy.

Installation

1. See Figure 7-8. Insert fuse block (13) from back side of caddy. Make sure tabs on caddy are secured to top and bottom of fuse block.
2. Insert main fuse holder (15) into caddy. Make sure the tabs on the top and bottom of the fuse holder are fastened to the caddy.
3. Route wires for siren, data link connector, ABS diode pack, and excess wire loop for AM/FM antenna, if used, through square shaped opening (9).
4. Install harness cover (11).
5. Secure wires with front and rear cable straps (1, 4).
6. See Figure 7-7. Install screws (2). Tighten to 72-96 **in-lbs** (8.1-10.9 Nm).
7. Install ABS diode pack (5), if ABS installed, date link connector (6), and fuse block cover (7) to caddy.
8. Install siren (8), if used and attach electrical connector to siren.
9. Attach excess wire loop for AM/FM antenna to caddy using a **new** cable tie (4).
10. Connect rear fender lights harness connector (1) and slide connector body onto mounting tab.
11. Install main fuse (3).

WARNING

After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

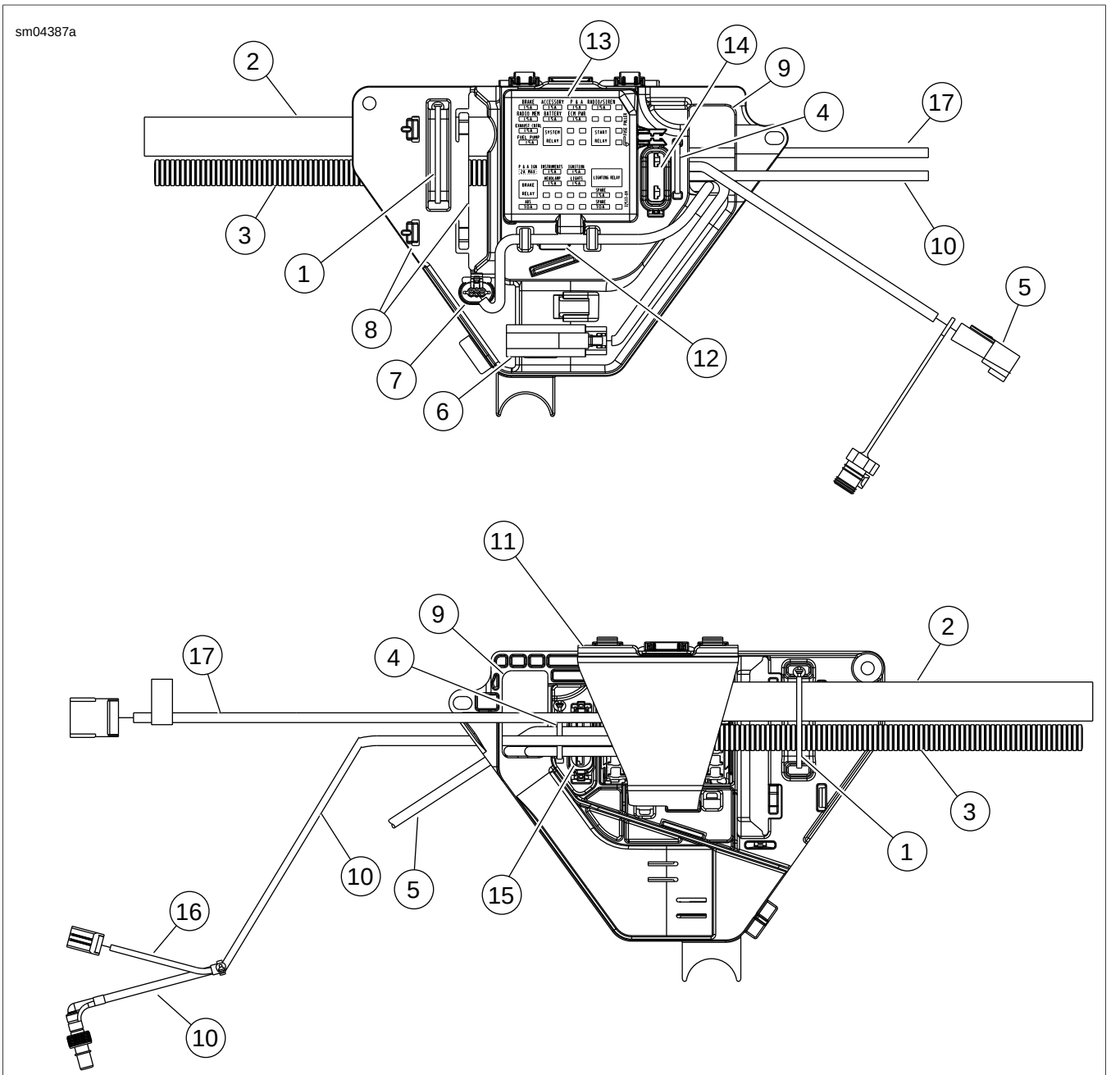
12. Install seat. See 2.28 SEAT.
13. Install left side cover.
14. Install left side saddlebag. See 2.29 SADDLEBAGS.

WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

15. Turn ignition on and test all lights and switches for proper operation.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Front cable strap**
2. **Main harness bundle**
3. **Main power cable**
4. **Rear cable strap**
5. **Data link connector [91]**
6. **ABS diode pack [201]**
7. **P&A siren connector [142]**
8. **Siren compartment/retaining latches**
9. **Square shaped opening**
10. **AM/FM Antenna harness**
11. **Harness cover**
12. **Harness cover tongue slot**
13. **Fuse block**
14. **Main fuse**
15. **Main fuse holder**
16. **Tour-Pak harness**
17. **Rear fender lights harness [7]**

Figure 7-8. Left Side Caddy (Typical)

BATTERY TRAY

Removal

1. Remove battery. See 1.17 BATTERY MAINTENANCE.
2. Remove rear wheel. See 2.5 REAR WHEEL.
3. Remove left side caddy. See 7.7 ELECTRICAL CADDIES, Left Side Caddy.

4. If Tour-Pak harness is routed through side of battery tray, disconnect Tour-Pak connectors and pull harness away from battery tray.
5. Remove ignition coil. See 7.5 IGNITION COIL.
6. Remove ABS module, if equipped. See C.1 ABS MODULE.
7. Pull TSM/HFSM away from battery tray. See 7.17 TSM/HFSM.
8. If active exhaust actuator is not used, disconnect actuator connector from battery tray.
9. Remove four screws securing battery tray to frame.
10. Pull battery tray rearward out through frame.

Installation

1. Install battery tray in from behind frame.
2. Install four screws securing battery tray to frame. Tighten to 72-96 **in-lbs** (8.1-10.9 Nm).
3. If active exhaust actuator is not used, connect actuator connector to battery tray.
4. Install TSM/HFSM onto battery tray. See 7.17 TSM/HFSM.
5. Install ABS module, if equipped. See C.1 ABS MODULE.
6. Install ignition coil. See 7.5 IGNITION COIL.
7. If equipped with Tour-Pak, route harness through side of battery tray and connect Tour-Pak connectors. Install cable ties to secure harness.
8. Install left side caddy. See 7.7 ELECTRICAL CADDIES, Left Side Caddy.
9. Install rear wheel. See 2.5 REAR WHEEL.
10. Install battery and top caddy. See 1.17 BATTERY MAINTENANCE.

WARNING

After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

11. Install seat. 2.28 SEAT.

WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

12. Turn ignition on and test switches and lights for proper operation.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

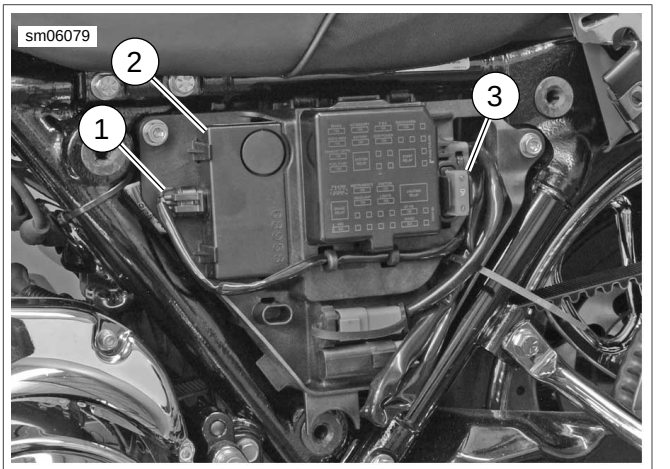
SECURITY SIREN 7.8

REMOVAL

1. Remove left side saddlebag. See 2.29 SADDLEBAGS.
2. Remove left side cover.
3. See Figure 7-9. Remove main fuse (3).
4. Disconnect security siren connector [142] (1).
5. Remove security siren (2).

INSTALLATION

1. See Figure 7-9. Install security siren (2).
2. Connect security siren connector [142] (1).
3. Install main fuse (3) into holder.
4. Install left side cover.
5. Install left side saddlebag. See 2.29 SADDLEBAGS.



1. Security siren connector [142]
2. Security siren
3. Main fuse

Figure 7-9. Security Siren

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

STARTER 7.9

GENERAL

The starter is made up of a field coil assembly, solenoid assembly and drive assembly. The repair instructions contained in this section are divided into three major service areas accordingly.

NOTE

For troubleshooting and diagnostic information, see the electrical diagnostic manual for this motorcycle.

Wiring Diagrams

The starting circuit wiring diagram contains information about wiring configuration. For additional information, see the electrical diagnostic manual for this motorcycle.

Paint Touch-Up

On painted starters, paint is applied to the starter after assembly. Many of the procedures in this section involve disassembly of several painted joints. When servicing the starter, paint damage or flaking may occur in the area of these joints. Any damaged paint should be touched up after assembly prior to installation using the appropriate touch up paint. Follow the directions provided with the paint. Paint flaking does not require the starter to be replaced.

REMOVAL

1. Remove seat. See 2.28 SEAT.

⚠WARNING

Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)

2. Remove battery negative (-) cable (black) from battery.

NOTE

The battery positive cable and power wire for the main fuse are crimped together at the starter ring terminal. Both must be replaced as an assembly if either requires replacement. See A.4 DELPHI MAIN FUSE HOUSING for removal of power wire from main fuse connector.

3. Remove battery positive and main fuse power cable ring terminal from starter solenoid stud.
4. Remove starter solenoid connector [128] at front of starter.
5. Remove engine oil filler cap/dipstick. Cover fill spout with clean shop cloth to keep out dirt and debris.
6. Remove starter front and rear mounting screws.
7. Remove starter from motorcycle. Exercise caution to avoid losing the ring dowels.

FIELD COIL ASSEMBLY

Disassembly

1. Remove screw to release chrome end cover, if equipped.
2. Remove two nuts to release end cover bracket from thru bolts, if equipped.
3. Pull up rubber boot and remove hex nut with captive lockwasher to release field wire ring terminal from post on solenoid housing.
4. Loosen two thru bolts to release field coil from solenoid housing.
5. Pull field coil with end cap from solenoid housing.
6. Remove armature from field coil. Separating end cap and field coil flanges will facilitate removal.
7. Placing field coil on wooden block to prevent damage, use impact driver to remove two screws with captive washers from end cap. Discard screws.
8. Remove end cap from field coil.
9. Locate the two brushes attached to the field coil winding. Pushing on inboard side of one brush, grasp free end of brush spring on outboard side with the hooked end of a suitable pick. Raise end of brush spring only as far as necessary to free brush from brush holder. Repeat step to release second brush and then remove brush holder from field coil.

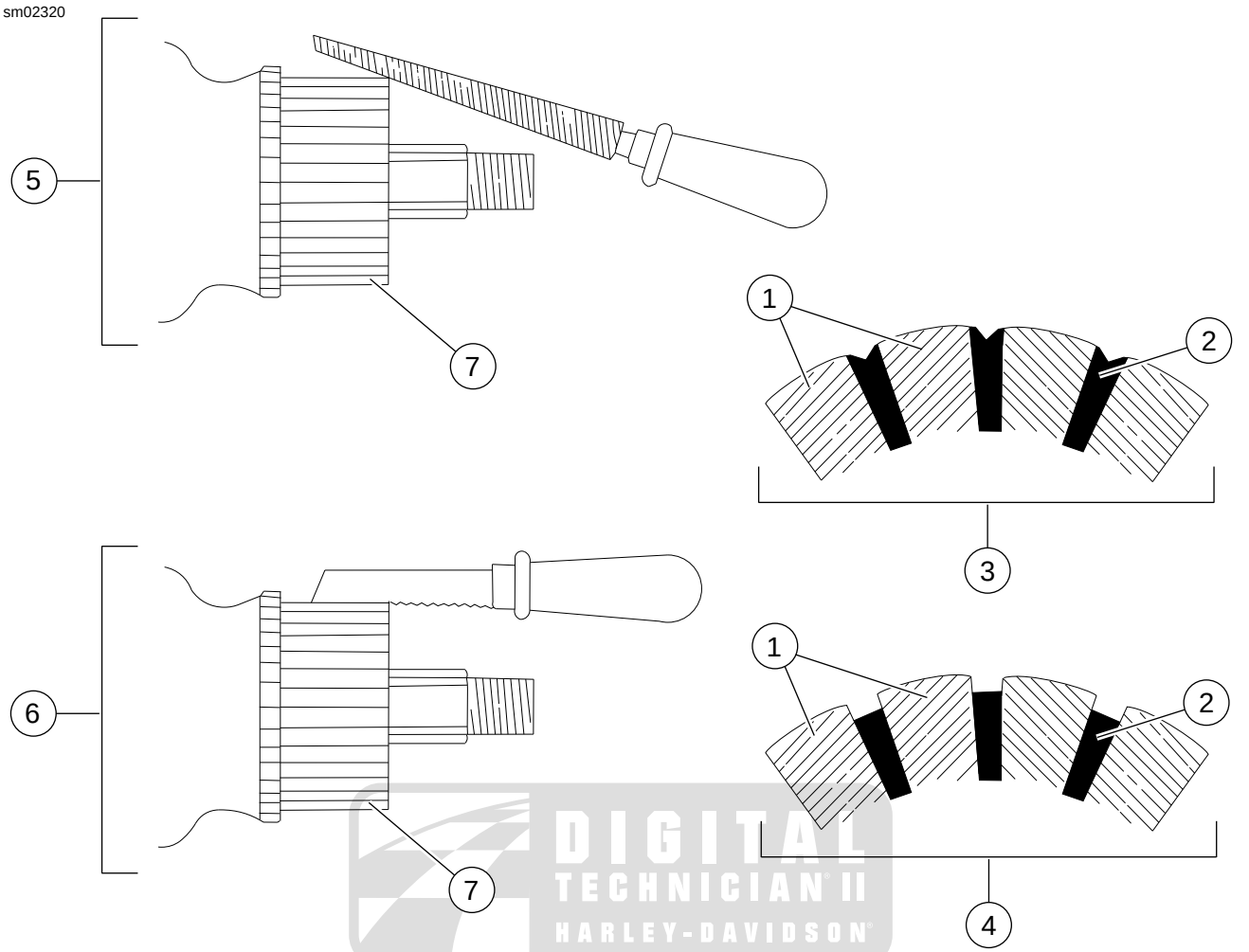
Inspection

1. For testing procedures, see the electrical diagnostic manual.
2. Inspect two O-rings in field coil bore for cuts, tears or signs of deterioration.
3. Place armature in lathe or truing stand and check runout of commutator. Commutators with more than 0.015 in. (0.38 mm) of runout should be replaced or machined on a lathe. Commutators should be replaced when diameter is less than 1.141 in. (29.98 mm).
4. Check depth of mica on commutator. If undercut is less than 0.008 in. (0.20 mm), use an undercutting machine to undercut the mica to 1/32 in. (0.79 mm) deep. The slots should then be cleaned to remove any dirt or copper dust.

NOTES

- *See Figure 7-10. If an undercutting machine is not available, undercutting can be done satisfactorily using a thin hacksaw blade. After undercutting, lightly sand the armature with crocus cloth to remove any burrs.*
- *Do not use sandpaper or emery cloth on commutator. The abrasive grit may remain on commutator segments and could cause excessive brush wear.*

5. Inspect armature roller bearings. Bearings must rotate freely without drag or sticking. Replace the bearings if pitted or grooved.
6. Replace brush springs if bent or distorted.



1. **Segments**
2. **Mica**
3. **Incorrect (Mica must not be left with a thin edge next to segments)**
4. **Correct (Mica must be cut away clean between segments)**
5. **Starting groove in mica with 3 cornered file**
6. **Undercutting mica with piece of hacksaw blade**
7. **Commutator**

Figure 7-10. Undercutting Mica Separators

Assembly

1. Attach brush holder to field coil. Locate the two brushes attached to the field coil winding. Catch free end of brush spring with the hooked end of a suitable pick. Raise end of brush spring only as far as necessary to install brush into brush holder. Repeat step to install second brush.
2. Retract all four brushes for armature installation. For good results, obtain four paper clips. Bend free end of each paper clip outward approximately 90 degrees. Then, pushing on inboard side of brush, insert straight end of paper clip between outboard side of brush and inboard side of brush spring. Properly installed, the paper clip contacts the framework of the brush holder to keep spring pressure off the brush. Repeat step on remaining three brushes as shown in Figure 7-11.
3. Install armature in solenoid housing so that larger bearing on splined end seats in counterbore. Lubricate armature bearings with high temperature grease, such as LUBRI-PLATE 110, before installation.
4. Mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on solenoid housing flange closest to the short (field wire) post on the solenoid housing.
5. Carefully place brush holder over armature. If additional clearance is needed, use a small flat blade screwdriver to gently push back the brushes slightly.
6. When the brush holder is centered over the armature, remove four paper clips to release brush springs. Verify that ends of brush springs make proper contact with brush sides.

7. Install end cap aligning holes in cap with those in brush holder. Start two **new** screws with captive washers. Tighten screws until snug.
8. Install thru bolts to fasten field coil to solenoid housing. Tighten thru bolts to 39-65 **in-lbs** (4.4-7.3 Nm).
9. Attach field wire ring terminal to short post on solenoid housing and install hex nut with captive lockwasher. Tighten hex nut to 70-90 **in-lbs** (7.9-10.2 Nm). Cover field wire ring terminal with rubber boot.
10. Install end cover bracket onto threaded end of thru bolts, if equipped. For proper orientation, be sure that the longest end of the bracket (before the bend) is on the field wire side. Install two nuts and tighten until snug.
11. Install screw to fasten chrome end cover to end cover bracket, if equipped. Tighten screw to 90-110 **in-lbs** (10.2-12.4 Nm).

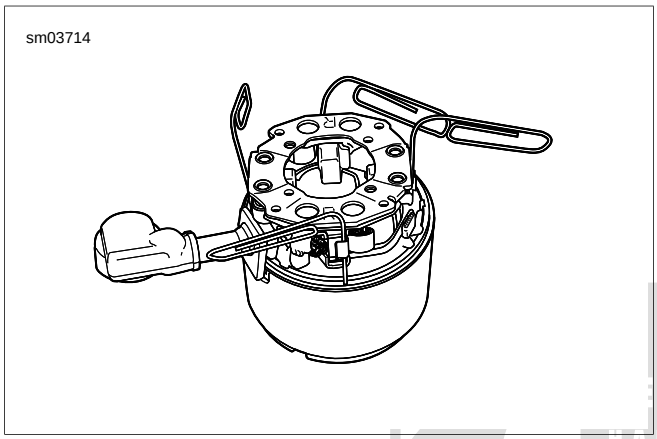


Figure 7-11. Install Paper Clips to Hold Brush Springs

DRIVE ASSEMBLY

Disassembly

1. Remove field coil. See 7.9 STARTER, Field Coil Assembly.
2. Pull field coil with end cap from solenoid housing. Hold end cap to field coil to avoid pulling armature out of brush holder. If armature is pulled from brush holder, further disassembly is required.
3. Using a 9 mm socket, remove two hex screws with Phillips recess to release drive housing from solenoid housing.
4. Use a rubber mallet to separate drive and solenoid housings, if necessary.
5. Remove idler gear from bearing cage in drive housing. Remove bearing cage with five steel cylinders from shaft in drive housing.
6. Push on end of drive shaft to remove starter clutch assembly from drive housing.
7. Compressing internal springs, remove snap ring from groove at end of drive shaft.
8. Remove cup, pinion gear, short spring and spring seat from splined end of drive shaft.
9. Push on splined end of drive shaft to remove from starter clutch bore.
10. Remove long spring from drive shaft. Remove steel ball from drive shaft bore.
11. Remove return spring from solenoid plunger shaft.

Inspection

1. Inspect two o-rings in drive housing bore for cuts, tears or signs of deterioration.
2. Replace springs if kinked, elongated or distorted.
3. Inspect pinion gear and drive shaft gear. Replace if pitted, scored, rounded, cracked, chipped or worn.
4. Inspect roller bearings. Bearings must rotate freely without drag or sticking. Replace the bearings if pitted or grooved.
5. Inspect the steel ball for wear, pitting, surface breakdown or other damage.
6. Replace snap ring if bent or distorted.

Assembly

1. Install long spring onto drive shaft. Install steel ball in drive shaft bore. Insert splined end of drive shaft into starter clutch bore (gear side).
2. Insert a deepwell socket into starter clutch bore and stand assembly upright on work bench with the socket side down.
3. Push down on starter clutch, so that installed socket pushes against the drive shaft gear to compress the spring. Holding assembly with spring compressed, install spring seat, short spring, pinion gear and cup on splined end of drive shaft. Be sure that the collar on the pinion gear and the concave side of the cup both face the splined end of the drive shaft.
4. While pushing down to simultaneously compress both the long and short springs installed, install snap ring in groove at splined end of drive shaft. Verify that snap ring is fully seated in the groove and that it resides in concave portion of cup when spring tension is released.
5. Remove deepwell socket from starter clutch bore.
6. Install bearing cage with five steel cylinders onto shaft in drive housing. Be sure that all five steel cylinders are installed in grooves of bearing cage. Install idler gear over bearing cage. Lubricate parts with high temperature grease, such as LUBRIPLATE 110, during assembly.
7. Install starter clutch assembly in drive housing seating the larger bearing in the counterbore. Lubricate bearings with LUBRIPLATE 110 before installation.
8. Apply a light film of Lubriplate 110 to solenoid plunger shaft. Install return spring on solenoid plunger shaft.
9. Mate the solenoid and drive housings and install two hex screws using a 9 mm socket. Alternately tighten hex screws until snug.
10. Lubricate armature bearing with LUBRIPLATE 110. Seating armature bearing in counterbore, mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on

solenoid housing flange closest to the short (field wire) post on the solenoid housing.

11. Install field coil. See 7.9 STARTER, Field Coil Assembly.

INSTALLATION

1. Verify that two ring dowels are installed in the primary chaincase or starter flange.
2. Lubricate O-ring on starter and bore of primary chaincase with light film of clean primary chaincase lubricant.
3. Move starter into its installed position and start both mounting screws.
4. Tighten starter mounting screws to 22-24 ft-lbs (29.8-32.5 Nm).
5. Remove shop cloth over fill spout and install engine oil filler cap/dipstick at top of transmission case.
6. Install battery positive cable on stud of solenoid. Install hex nut and tighten to 70-90 **in-lbs** (7.9-10.2 Nm). Pull down rubber boot over terminal connections.
7. Install starter solenoid connector [128] at front of starter.

CAUTION

Do not over-tighten bolts on battery terminals. Use recommended torque values. Over-tightening battery terminal bolts could result in damage to battery terminals. (00216a)

8. Connect battery negative (-) cable to battery and tighten bolt to 60-70 **in-lbs** (6.8-7.9 Nm).
9. Install seat. See 2.28 SEAT.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

STARTER SOLENOID 7.10

SOLENOID ASSEMBLY

Disassembly

1. Remove field coil. See 7.9 STARTER, Field Coil Assembly.
2. Pull field coil with end cap from solenoid housing. Hold end cap to field coil to avoid pulling armature out of brush holder. If armature is pulled from brush holder, further disassembly is required.
3. Using a 9 mm socket, remove two hex screws with Phillips recess to release solenoid housing from drive housing.
4. Use a rubber mallet to separate solenoid and drive housings, if necessary.
5. Remove return spring from solenoid plunger shaft.

Assembly

1. Install return spring on solenoid plunger shaft.
2. Mate the solenoid and drive housings and install two hex screws using a 9 mm socket. Alternately tighten hex screws until snug.
3. Lubricate armature bearing with LUBRIPLATE 110. Seating armature bearing in counterbore, mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on solenoid housing flange closest to the short (field wire) post on the solenoid housing.
4. Install field coil. See 7.9 STARTER, Field Coil Assembly.

SOLENOID PLUNGER

Disassembly

1. Remove three hex screws to release solenoid cover.
2. Remove rubber gasket from solenoid cover flange.
3. Remove plunger and return spring.

Assembly

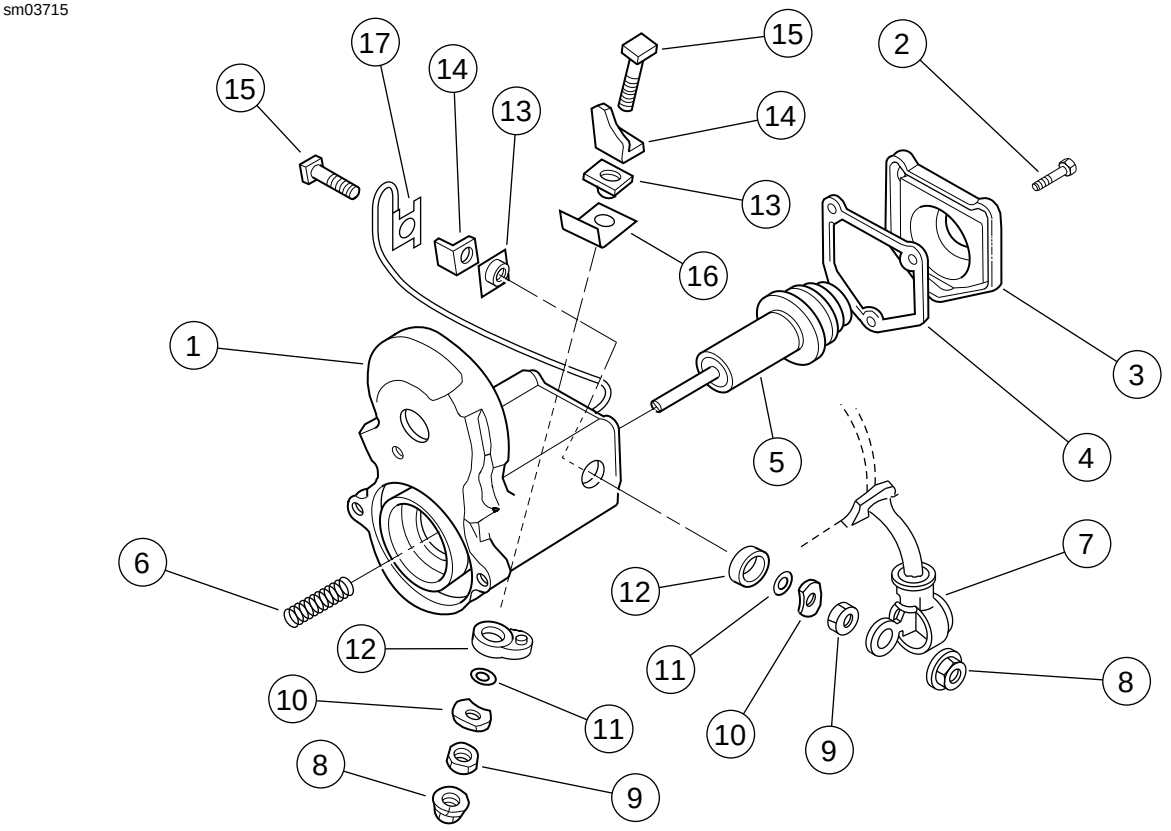
1. Apply a light film of LUBRIPLATE 110 to plunger shaft and install return spring. Install plunger in solenoid.
2. Install **new** rubber gasket on solenoid cover flange.
3. Install three hex screws to secure solenoid cover. Alternately tighten hex screws until snug.

SOLENOID CONTACTS

Disassembly

1. Remove three hex screws to release solenoid cover.
2. Remove rubber gasket from solenoid cover flange.
3. Remove plunger and return spring.
4. Obtain Solenoid Contact Repair Kit.
5. Disassemble short post (field coil):
 a. See Figure 7-12. Remove hex nut from post, if still installed. Remove jam nut, wave washer, round bushing and o-ring from post.
 b. On inside of solenoid housing, remove post bolt, hold-in terminal, contact plate and square bushing.
6. Disassemble long post (battery):
 a. Remove hex nut from post, if still installed. Remove jam nut, wave washer, round bushing and o-ring from post.
 b. On inside of solenoid housing, remove post bolt, contact plate, square bushing and paper insulator washer.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Solenoid**
2. **Hex screw**
3. **Solenoid cover**
4. **Rubber gasket**
5. **Plunger**
6. **Return spring**
7. **Rubber boot**
8. **Hex nut**
9. **Jam nut**
10. **Wave washer**
11. **O-ring**
12. **Round bushing**
13. **Square bushing**
14. **Contact plate**
15. **Post bolt**
16. **Paper insulator washer**
17. **Hold-in terminal**

Figure 7-12. Solenoid Assembly

Assembly

1. Assemble short post (field coil):
 a. From inside solenoid housing, insert sleeve on square bushing into hole in solenoid housing.
 b. With the foot inboard against solenoid winding, align hole in contact plate with hole in square bushing.
 c. Slide short post bolt through holes in hold-in terminal, contact plate, square bushing and solenoid housing.
 d. At outside of solenoid housing, install round bushing, O-ring and wave washer onto end of post. Install jam nut, but do not tighten.
2. Assemble long post (battery):
 a. On inside of solenoid housing, align hole in paper insulator washer with hole in solenoid housing. Insert sleeve on square bushing into holes.
 b. With the foot inboard against solenoid winding, align hole in contact plate with hole in square bushing.
 c. Slide long post bolt through holes in contact plate, square bushing, paper insulator washer and solenoid housing.
 d. At outside of solenoid housing, install round bushing, o-ring and wave washer onto end of post. Verify that index pin on round bushing engages blind hole in solenoid housing. Install jam nut, but do not tighten.
3. Apply a light film of LUBRIPLATE 110 to plunger shaft and install return spring. Install plunger in solenoid.

4. While depressing plunger, alternately tighten jam nuts to 65-80 **in-lbs** (7.3-9.0 Nm). Verify that contact plates have not rotated out of alignment with plunger.
5. Install **new** rubber gasket on solenoid cover flange.
6. Install three hex screws to secure solenoid cover. Alternately tighten hex screws until snug.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

HEADLAMP: ALL EXCEPT FLTR 7.11

HEADLAMP ASSEMBLY

Removal

1. Remove screw at bottom of headlamp door (chrome ring). Remove headlamp door.
2. Proceed as follows:
 a. **FLHR/C:** Remove seven screws from headlamp housing and carefully pull headlamp assembly from headlamp nacelle.
 b. **FLHX, FLHT/C/U:** See Figure 7-13. Remove three screws from retaining ring and carefully pull headlamp assembly from outer fairing.
3. Remove headlamp connector [38] at back of headlamp bulb.

Installation

1. Install headlamp connector [38] at back of headlamp bulb.
2. Proceed as follows:
 a. **FLHR/C:** Align holes in headlamp housing with wellnuts in headlamp nacelle (headlamp door bracket at bottom). Install seven screws and alternately tighten to 9-18 **in-lbs** (1.0-2.0 Nm).
 b. **FLHX, FLHT/C/U:** See Figure 7-13. Align holes in retaining ring of headlamp assembly with those in outer fairing (headlamp door bracket at bottom). Install three screws and alternately tighten to 23-28 **in-lbs** (2.6-3.2 Nm).
3. Fit the square-shaped portion of the headlamp door spring into slot at top of headlamp housing and then snap the headlamp door (chrome ring) into place. Install screw at bottom of headlamp door and tighten to 9-18 **in-lbs** (1.0-2.0 Nm).

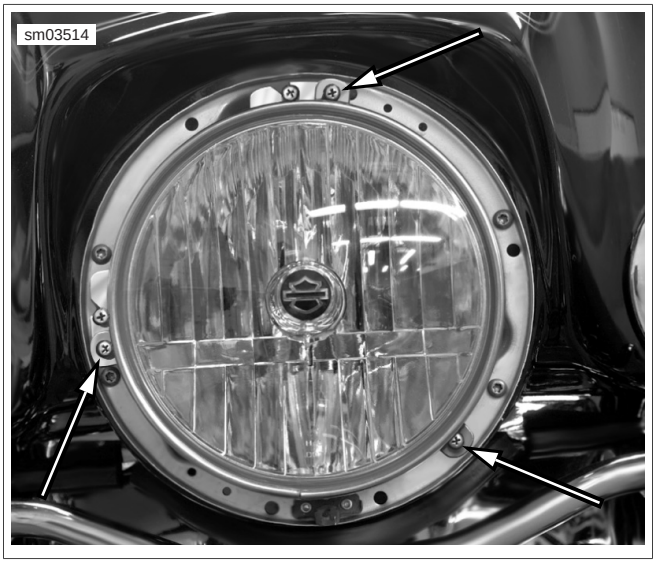


Figure 7-13. Remove Retaining Ring Screws (FLHX, FLHT/C/U)

HEADLAMP BULB REPLACEMENT

The headlamp bulb is replaceable (not a sealed beam). Made of quartz glass filled with Halogen gas, the bulb is very delicate and must be handled with care. Avoid touching with bare fingers as skin oil can cause premature failure.

NOTE

When replacement is required, use only the specified bulb available from your Harley-Davidson dealer. Improper wattage or bulb may cause charging system problems.

1. Remove headlamp assembly.
2. Remove rubber boot at back of lens.
3. See Figure 7-14. Press down on wireform loop and push pin end out from under lip of retainer to release. Use hinge to swing wireform out of the way.

NOTE

If it is difficult to free pin end of wireform from under lip of retainer, loosen retainer screw 1/2-1 turn and then repeat above step.

⚠WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

4. Remove and discard bulb.

CAUTION

Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Grab the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210a)

5. Install **new** bulb in lens. Rotate bulb as necessary so that wider ear on backplate points toward the top of the headlamp assembly.

NOTE

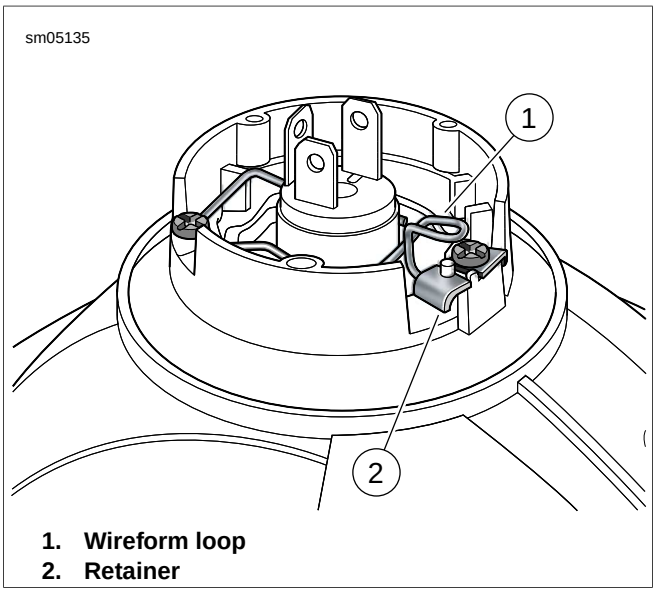
The top of the headlamp assembly can be determined by the orientation of the decorative logo on the opposite side, or the location of the headlamp door bracket, which is always at the bottom of the assembly.

6. See Figure 7-14. Use hinge to rotate wireform over socket at back of bulb. Press down on loop and push pin end under lip of retainer to secure.

NOTE

If retainer screw was loosened to release wireform, use finger to hold retainer in place and then slowly tighten screw until snug. Turning headlamp assembly over, verify that reflector cone is still centered under decorative logo. If it is not, loosen retainer screw and repeat step until the proper results are achieved.

7. Install rubber boot at back of lens.
8. Install headlamp assembly.



1. **Wireform loop**
2. **Retainer**

Figure 7-14. Headlamp Bulb Assembly

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

HEADLAMP: FLTR 7.12

HEADLAMP ASSEMBLY

Removal

1. Remove outer fairing. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
2. Move outer fairing assembly to bench area.
3. Remove headlamp harness connectors.

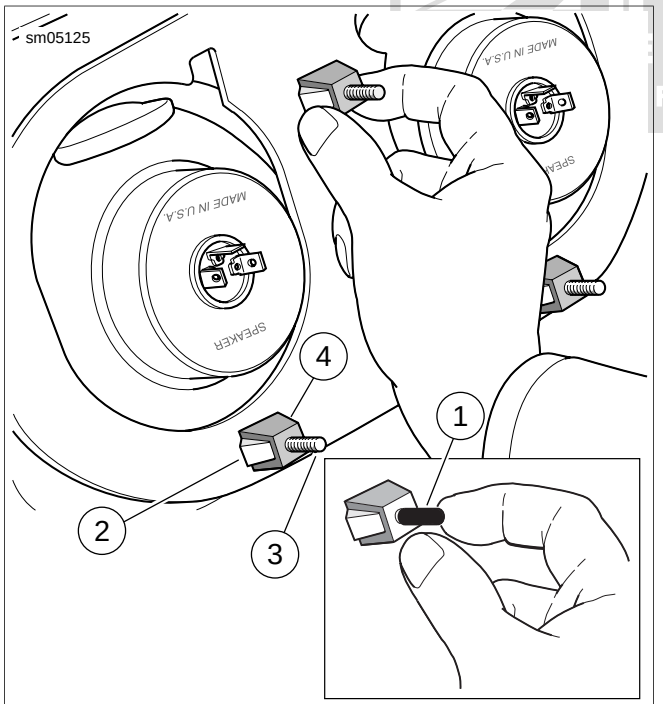
NOTE

Wrap electrical tape around blade of screwdriver to prevent damage to tabs of transparent lens cover.

4. From inboard side of outer fairing, release top of transparent lens cover from slots in fairing by gently depressing two tabs with blade of screwdriver. Depress two bottom tabs and remove lens cover from fairing.
5. See inset of Figure 7-15. Remove protective sleeve from top center hex adjuster stud.
6. Depress mounting clips on all three hex adjuster studs and pull headlamp assembly out front of outer fairing.

Installation

1. At front of outer fairing, align ends of hex adjuster studs with holes in plastic bosses. Push headlamp assembly into position until mounting clips engage outer fairing.



1. **Protective sleeve**
2. **Mounting clip**
3. **Hex adjuster stud**
4. **Plastic boss**

Figure 7-15. Depress Mounting Clips

NOTE

See inset of Figure 7-15. To avoid cutting or chafing wires, be sure to install protective sleeve on top center stud of headlamp assembly.

2. Carefully snap bottom tabs of transparent lens cover into bottom slots of outer fairing. Carefully snap upper tabs of lens cover into upper slots of fairing.
3. Install headlamp harness connectors.
4. Install outer fairing. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.

HEADLAMP BULB REPLACEMENT

NOTES

- *The headlamp is a replaceable bulb (and not a sealed beam). Made of quartz glass filled with Halogen gas, the bulb is very delicate and must be handled with care.*
- *When replacement is required, use only the specified bulb available from your Harley-Davidson dealer. Improper wattage or bulb may cause charging system problems.*

Removal

1. Remove outer fairing. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
2. Move outer fairing assembly to bench area.
3. Remove headlamp harness connector.
4. Remove rubber boot at back of bulb housing.
5. See Figure 7-16. Rotate retainer in a counter-clockwise direction to remove from bulb housing.

⚠WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

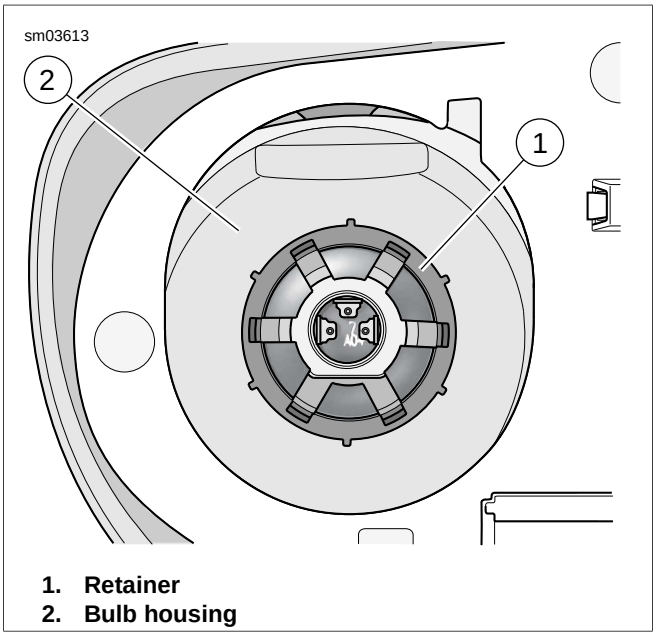
6. Remove and discard bulb.

Installation

CAUTION

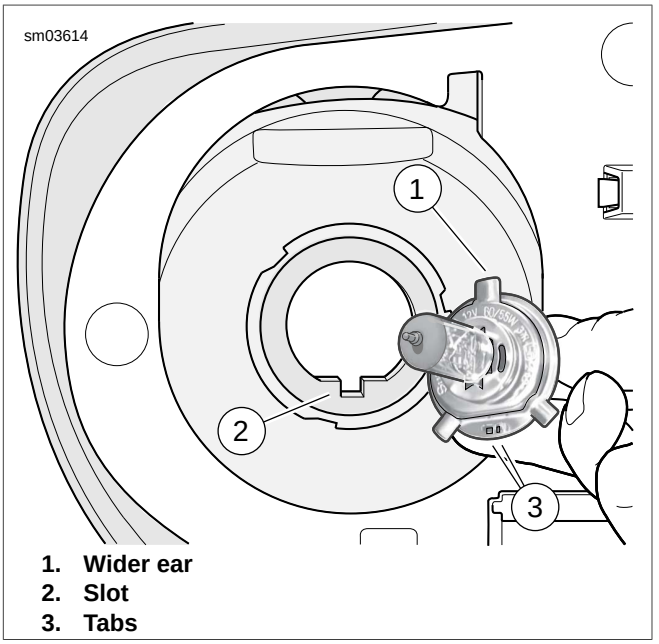
Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Grab the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210a)

1. See Figure 7-17. Install **new** bulb in bulb housing. Orient bulb so that wider ear on backplate is topside and then push bottom of backplate so that tabs on outboard side fit snugly in slot of bulb housing.
2. See Figure 7-16. Place retainer over bulb housing and rotate in a clockwise direction until tight.



1. **Retainer**
2. **Bulb housing**

Figure 7-16. Remove Retainer to Release Bulb



1. **Wider ear**
2. **Slot**
3. **Tabs**

Figure 7-17. Install New Bulb in Bulb Housing

3. Install rubber boot over retainer until flush with base of bulb socket.
4. Install headlamp harness connector.
5. Install outer fairing. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

AUXILIARY LAMPS AND BRACKETS 7.13

AUXILIARY LAMP BULB

Removal

1. See Figure 7-18. Loosen auxiliary lamp door screw as required to pull lamp door from lip of lamp housing.
2. See Figure 7-19. Disconnect auxiliary lamp connector [199L/R], 2-place Packard.
3. Remove nesting ring at back of lens.

⚠WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

4. See Figure 7-20. Rotate bulb/pin housing 1/4 turn in a counterclockwise direction and remove from lens. Discard bulb/pin housing.

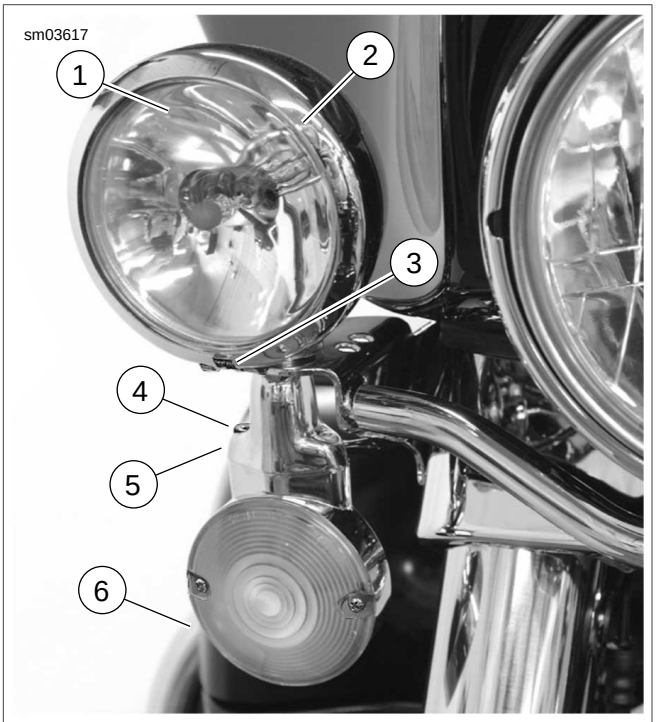
CAUTION

Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Grab the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210a)

5. See Figure 7-20. Install **new** bulb/pin housing in lens and rotate 1/4 turn in a clockwise direction.

Installation

1. See Figure 7-19. Place nesting ring at back of lens with the concave side up.
2. See Figure 7-19. Connect auxiliary lamp connector [199L/R], 2-place Packard.
3. Place nesting ring over edge of lamp housing. Rotate nesting ring until index tab engages slot at bottom of lamp housing.
4. Holding nesting ring in place, rotate lens so that index tabs at back engage slots in nesting ring.
5. Install lamp door over lip of lamp housing. Rotate lamp door so that screw is centered at bottom, and then tighten door screw until snug.



1. **Auxiliary lamp**
2. **Door**
3. **Door screw**
4. **Allen head screw (2)**
5. **Mounting bracket**
6. **Turn signal lamp**

Figure 7-18. Auxiliary and Front Turn Signal Lamp



1. **Lamp index tab**
2. **Nesting ring index tab**

Figure 7-19. Auxiliary Lamp Assembly



Figure 7-20. Auxiliary Lamp Bulb/Pin Housing

AUXILIARY LAMP HOUSING

Removal

NOTE

See Figure 7-23. If replacing only the lamp housing, begin at step 1. Start at step 2 if replacing the entire lamp assembly.

1. Disassemble auxiliary lamp. See 7.13 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Bulb.
2. Proceed as follows:
 a. **FLHR/C:** See Figure 7-21. Remove headlamp assembly. See 7.11 HEADLAMP: ALL EXCEPT FLTR. Disconnect auxiliary lamps connector [73], 2-place Multilock.
 b. **FLHT/C/U:** See Figure 7-22. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U. Disconnect the left or right front turn signal/auxiliary lamp connector [31L/R], 4-place Multilock, on T-stud at top of left or right fairing support brace (outboard side).
3. Remove appropriate terminal(s) from socket housing.

Table 7-6. FLHR/C Auxiliary Lamps [73]

LEFT SIDE		RIGHT SIDE	
WIRE COLOR	CHAMBER	WIRE COLOR	CHAMBER
Gray/Black	1	Gray/Black	2

Table 7-7. FLHT/C/U Auxiliary Lamps [31L/R]

LEFT SIDE [31L]		RIGHT SIDE [31R]	
WIRE COLOR	CHAMBER	WIRE COLOR	CHAMBER
Gray/Black	4	Gray/Black	4
Note: Terminals 1, 2 and 3 are reserved for the turn signal lamp.			

NOTE

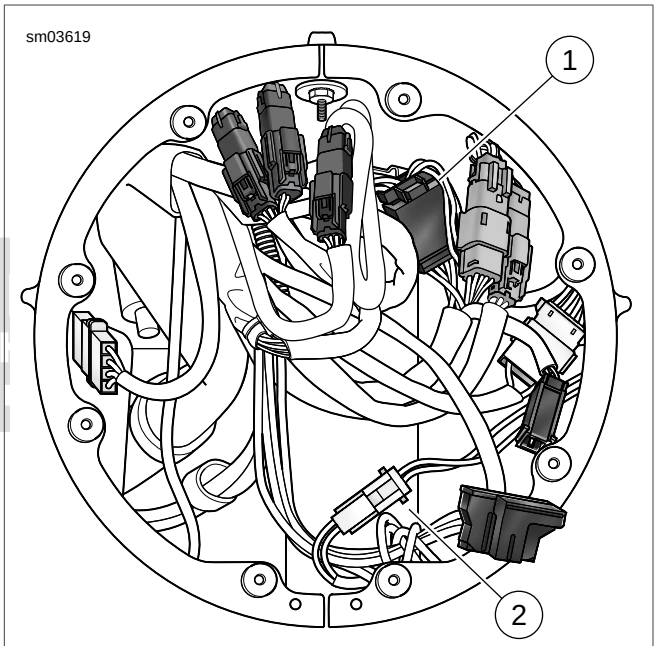
For instructions on removing terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

4. See Figure 7-18. Remove two allen head screws to release turn signal lamp from mounting bracket.
5. See Figure 7-24. Obtain length of strong flexible wire for use as mechanics wire. Feed wire through opening in socket terminal and then loop back twisting end until tightly coiled around longer strand.

NOTE

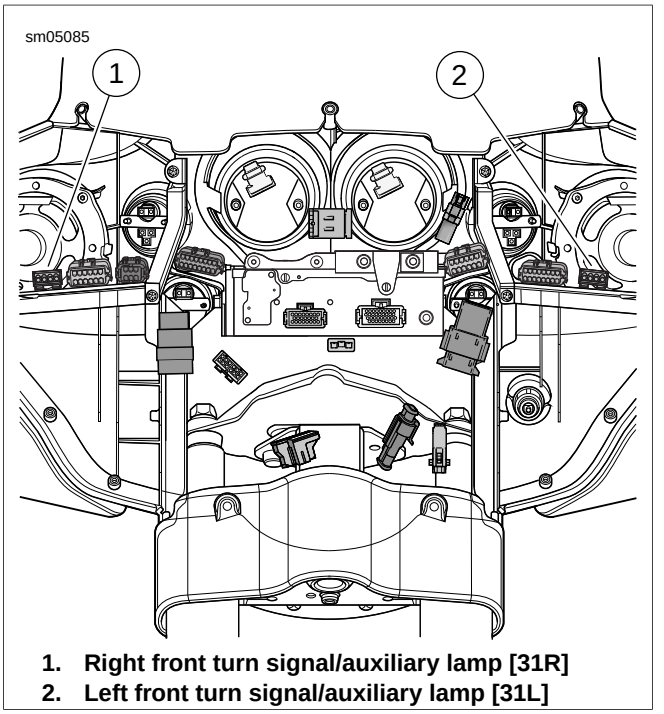
Be sure that mechanics wire is of sufficient strength to pull terminal through conduit without breaking. Wire length must also be long enough so that free end is not lost in conduit when pulled.

6. Carefully pull wire to draw socket terminal through conduit.
7. Unravel mechanics wire to release socket terminal.
8. Insert flare nut socket (Snap-on® FRX181) at bottom of turn signal mounting bracket and remove locknut from stud. Remove the turn signal mounting bracket and clamp block.
9. Remove auxiliary lamp (with Belleville washer and swivel block) from the auxiliary lamp bracket.



1. **Front turn signal lamps [31]**
2. **Auxiliary lamps [73]**

Figure 7-21. Headlamp Nacelle (FLHRC)



1. **Right front turn signal/auxiliary lamp [31R]**
2. **Left front turn signal/auxiliary lamp [31L]**

Figure 7-22. Inner Fairing (FLHT/C/U)

Installation

1. Lay old auxiliary lamp next to **new** auxiliary lamp and cut wire to length.
2. Strip 3/16 in (4.8 mm) of insulation off wire and crimp on **new** socket terminal.

NOTE

For instructions on crimping terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

3. If removed, slide swivel block and Belleville washer down wire onto auxiliary lamp stud. Be sure that rounded side of swivel block and concave side of Belleville washer face auxiliary lamp.
4. Feed wire through slot at top of auxiliary lamp bracket and insert threaded stud into forward slot. Slide clamp block (rounded side up), turn signal mounting bracket and locknut up wire onto auxiliary lamp stud at bottom of bracket.
5. Using flare nut socket (Snap-on® FRX181), tighten locknut to 15-18 ft-lbs (20.3-24.4 Nm).
6. Reattach mechanics wire to socket terminal and carefully pull end of mechanics wire to draw socket terminal back through conduit.
7. Carefully remove mechanics wire to avoid damage to terminal.
8. Install terminal into socket housing. Refer to Table 7-6 or Table 7-7.

NOTE

For instructions on installing terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

9. Connect front turn signal/auxiliary lamp connector.
10. Turn Ignition/Light Key Switch to IGNITION and test for proper operation and alignment. Adjust if necessary.
11. See Figure 7-18. Start two allen head screws to secure turn signal lamp to mounting bracket. Verify that conduit fits in slot at back of bracket and is not pinched. Alternately tighten screws to 36-60 **in-lbs** (4.1-6.8 Nm).
12. Proceed as follows:
 a. **FLHR/C:** Install headlamp assembly. See 7.11 HEADLAMP: ALL EXCEPT FLTR.
 b. **FLHT/C/U:** Install connector on T-stud at top of left or right fairing support brace (outboard side). Verify that conduit is routed inboard using relief in upper outboard corner of chrome skirt. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
13. Assemble auxiliary lamp, if necessary. See 7.13 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Bulb.

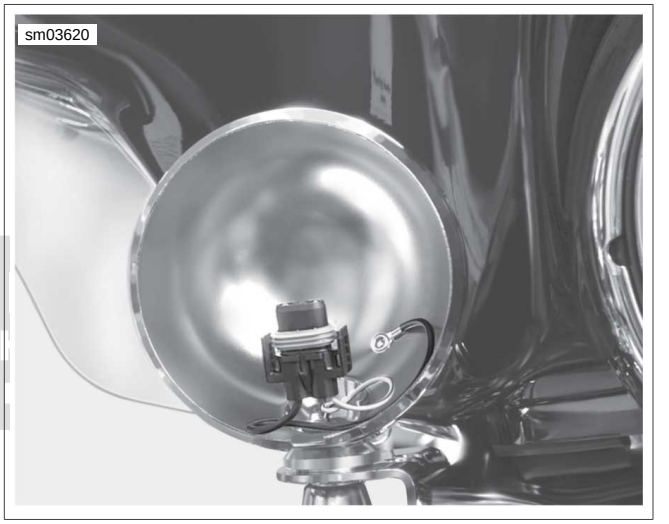


Figure 7-23. Auxiliary Lamp Housing

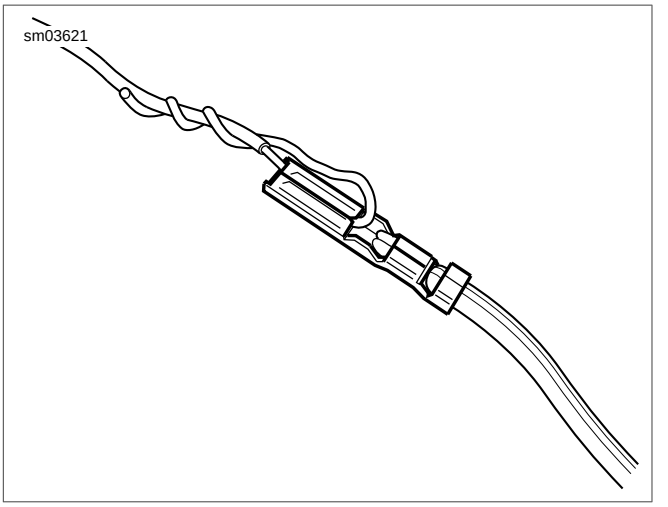


Figure 7-24. Fix Mechanics Wire to Socket Terminal

AUXILIARY LAMP BRACKET

Removal

1. Proceed as follows:
 a. **FLHR/C:** See Figure 7-21. Remove headlamp assembly. See 7.11 HEADLAMP: ALL EXCEPT FLTR. Disconnect auxiliary lamps connector [73], white 2-place Multilock. Disconnect front turn signal lamps connector [31], 6-place Multilock, anchored in hole of fork stem nut lockplate (left side).
 b. **FLHT/C/U:** See Figure 7-22. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U. Disconnect the left and right front turn signal/auxiliary lamp connectors [31L/R], 4-place Multilocks, on T-studs at top of left and right fairing support braces (outboard sides).
2. Proceed as follows:
 a. **FLHR/C:** Remove acorn nuts from fork bracket studs.
 b. **FLHT/C/U:** Loosen screws in upper and lower fork brackets.
3. Remove auxiliary lamp bracket from motorcycle.

Installation

1. Install auxiliary lamp bracket on motorcycle. Proceed as follows:
 a. **FLHR/C:** Slide slots of auxiliary lamp bracket onto upper and lower fork bracket studs. Install acorn nuts on studs. Alternately tighten acorn nuts to 72-108 **in-lbs** (8.1-12.2 Nm) using a crosswise pattern.
 b. **FLHT/C/U:** Slide slots of auxiliary lamp bracket onto screws in upper and lower fork brackets. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm) using a crosswise pattern.
2. Proceed as follows:
 a. **FLHR/C:** Connect auxiliary lamps connector [73], white 2-place Multilock. Connect front turn signal lamps connector [31], 6-place Multilock. Install anchor on connector into hole of fork stem nut lockplate (left side). Install headlamp assembly. See 7.11 HEADLAMP: ALL EXCEPT FLTR.
 b. **FLHT/C/U:** Connect the left and right front turn signal/auxiliary lamp connectors [31L/R], 4-place Multilocks. Install connectors on T-studs at top of left and right fairing support braces (outboard sides). Verify that conduit is routed inboard using reliefs in upper outboard corners of chrome skirt. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

ADJUSTMENT

See 1.23 HEADLAMP ALIGNMENT for alignment procedures.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TAIL LAMP 7.14

TAIL LAMP/TAIL LAMP BULB

Removal

1. See left side of Figure 7-25. Remove two screws from lens to release tail lamp assembly from chrome base.
2. See right side of Figure 7-25. Disconnect tail lamp connector [93], 4-place Multilock.
3. Rotate bulb socket 1/4 turn in a counterclockwise direction and remove from tail lamp assembly. Gently pull bulb from socket.

Installation

1. Gently push **new** bulb into socket. Insert socket into tail lamp assembly and rotate 1/4 turn in a clockwise direction.
2. See right side of Figure 7-25. Connect tail lamp connector [93], 4-place Multilock.
3. Place tail lamp into position against chrome base.
4. Install two screws and alternately tighten to 20-24 **in-lbs** (2.3-2.7 Nm).

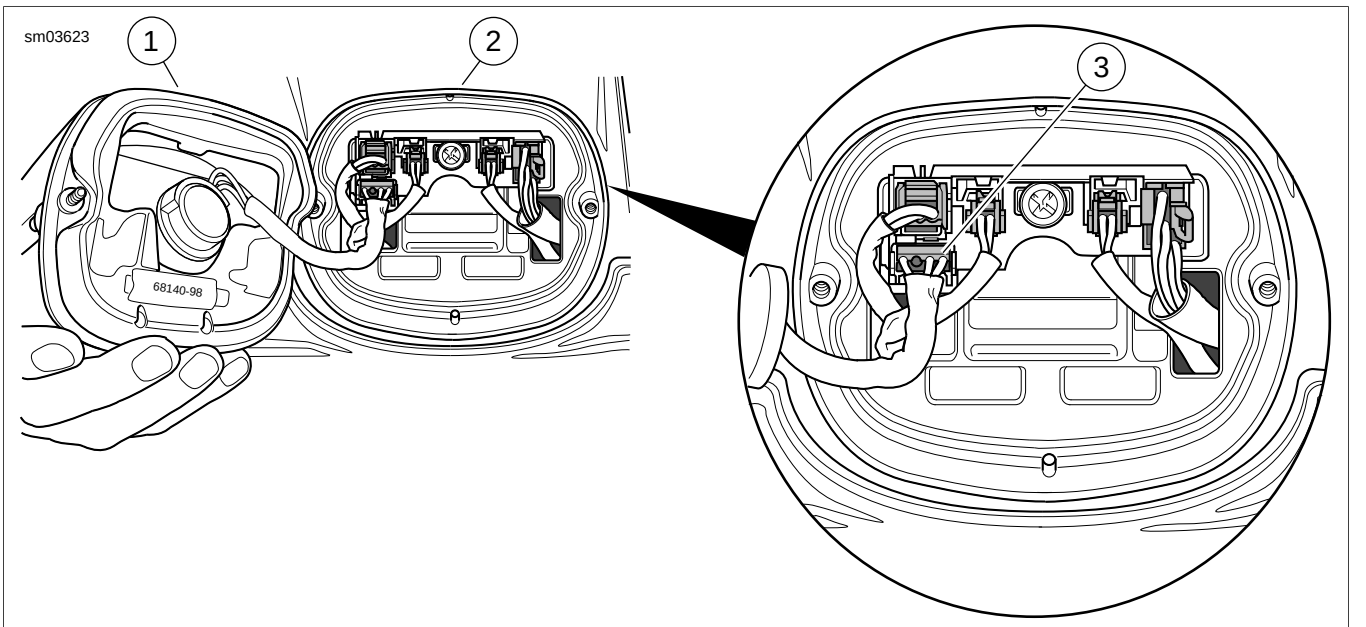
NOTE

Over tightening screws can crack the lens or result in scratching of the fender paint.

⚠WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

5. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.



1. **Tail lamp assembly**
2. **Chrome base**
3. **Tail lamp connector [93]**

Figure 7-25. Remove Tail Lamp and Depress Button to Release Socket Housing

CIRCUIT BOARD/CHROME BASE

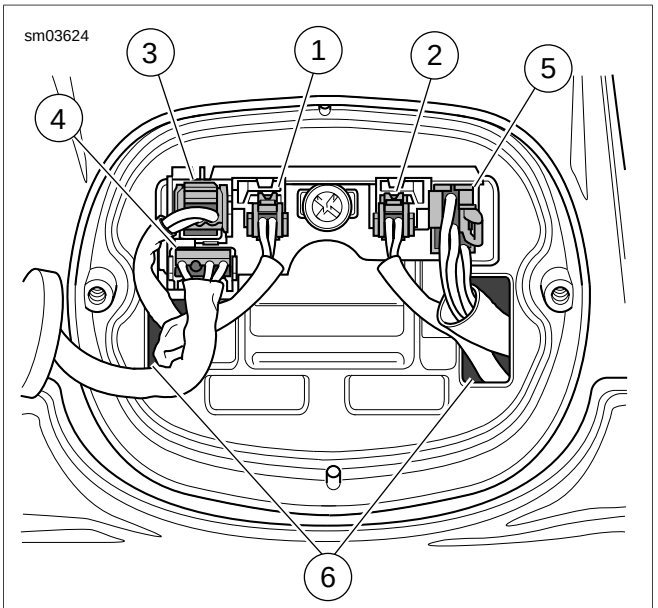
Removal

1. See left side of Figure 7-25. Remove two screws to release tail lamp assembly from chrome base.
2. See right side of Figure 7-25. Disconnect tail lamp connector [93], 4-place Multilock.
3. See Figure 7-26 and Figure 7-27. Disconnect remaining connectors. To release socket housings of left and right turn signal lamps, use a pick or small screwdriver to press button.

NOTE

The rear fender tip lamp is present on FLHR and FLHT/C/U models only. As the lamp is absent on FLHX models, the circuit board location is used for power to the license plate lamps, a feature unique to that model. On FLHRC and FLTR models, the location is unused.

4. Remove screw (with captive washer) at center of chrome base. Use both thumbs to push chrome base upward until it becomes free of fender and then pull out of fender hole.
5. See Figure 7-26. Feed socket housings through openings to inboard side of chrome base. For best results, free the smaller socket housings first.



1. **Left turn signal lamp [18]**
2. **Right turn signal lamp [19]**
3. **Rear fender tip lamp [45]**
4. **Tail lamp [93]**
5. **Rear fender lights harness [94]**
6. **Opening**

Figure 7-26. Rear Fender Lights Assembly

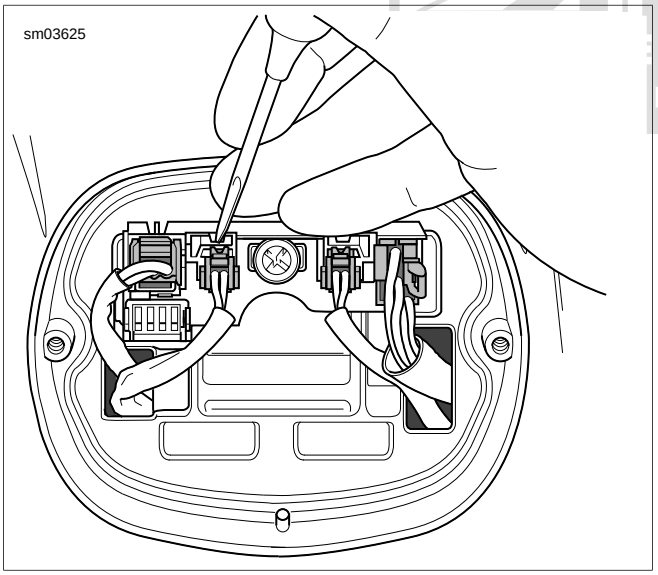


Figure 7-27. Use Pick Tool to Release Left Turn Signal Lamp Socket

6. Remove pin housing/circuit board from chrome base. For best results, push index pins on pin housing from holes in chrome base.

Installation

1. See Figure 7-26. Feed socket housings through openings to outboard side of chrome base. For best results, feed the larger socket housings first.
2. Fit bottom of chrome base into fender hole and then push down to align center hole with clip nut on fender flange.
3. See Figure 7-28. Place pin housing over circuit board, if removed.
4. Insert index pins at back of pin housing into holes in chrome base.
5. Install screw (with captive washer) to secure pin housing/circuit board and chrome base to clip nut on fender flange. Tighten screw to 40-48 **in-lbs** (4.5-5.4 Nm).

NOTE

Over tightening screw can crack the chrome base or result in scratching of the fender paint.

6. Install socket housings into pin housing/circuit board. Install rear fender tip lamp and both left and right turn signal lamp sockets so that the release buttons are at the top. Install the rear fender lights harness socket with the button on the outboard side and the tail lamp socket with the button at the bottom.
7. See Figure 7-25. To avoid stressing wires, verify that tail lamp conduit is positioned on the outboard side of the rear fender tip lamp and left turn signal lamp conduit.
8. Place tail lamp into position against chrome base.
9. Install two screws and alternately tighten to 20-24 **in-lbs** (2.3-2.7 Nm).

NOTE

Over tightening screws can crack the lens or result in scratching of the fender paint.

⚠WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

10. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

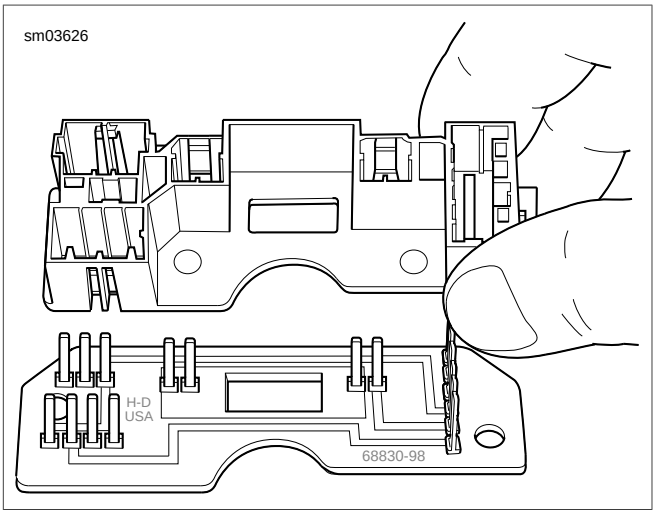


Figure 7-28. Place Pin Housing Over Circuit Board

REAR FENDER LIGHTS HARNESS

Removal

1. Remove rear fender. See 2.49 REAR FENDER.
2. See Figure 7-25. Remove two screws to release tail lamp assembly from chrome base.
3. Disconnect tail lamp connector [93], 4-place Multilock. Set tail lamp assembly aside.
4. See Figure 7-26. Disconnect rear fender lights connector [94], 6-place Multilock. Feed socket housing through opening to inboard side of fender.
5. Release left and right rear turn signal lamp conduit from respective cable clip anchored on T-stud. On FLHX models, also release license plate lamps conduit from left side cable clip. On FLHR and FLHT/C/U models, release rear fender tip lamp conduit from both left side cable clip and stamped fender clip.
6. Release rear fender lights harness from channel in stud plate. Loosen two flange nuts, if necessary.
7. Draw socket housing of rear fender lights connector [7], 8-place Multilock, through hole to inboard side of fender.
8. Remove wire harness and adhesive conduit from fender well.

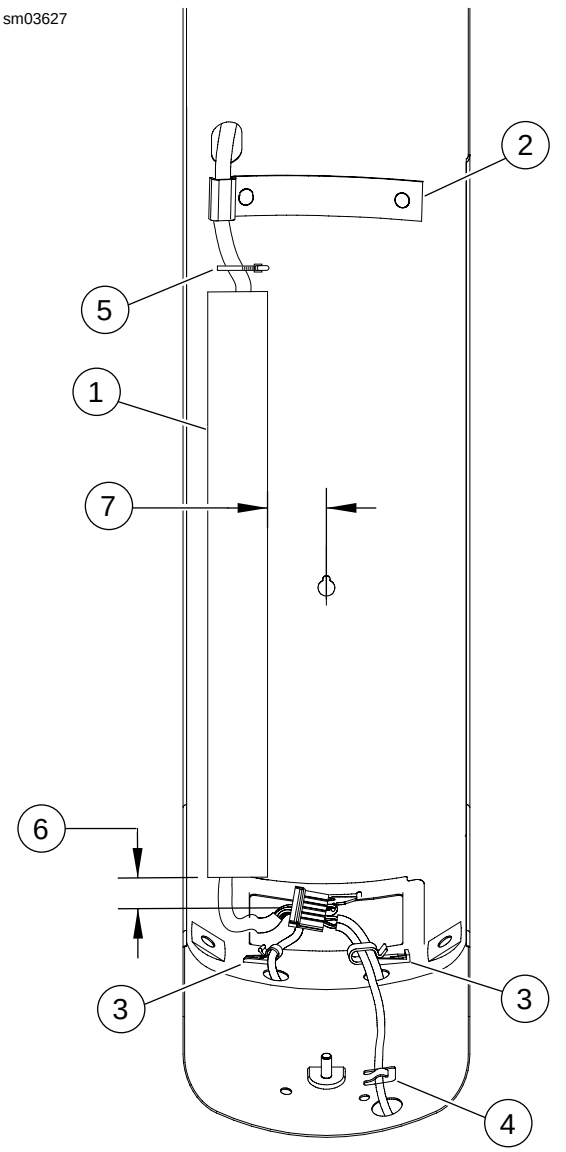
Installation

1. Proceed as follows:
 a. Thoroughly clean fender well with soap and water. Do not use solvents or harsh chemicals or damage to painted surfaces may occur.
 b. Remove remnants of old conduit, as well as all residual adhesive. For good results, use 3M general Purpose adhesive remover (Part No. 051135).
 c. See Figure 7-29. Using a soapy Scotch Brite® pad, thoroughly clean fender well in area of adhesive conduit.
 d. Rinse with clear water and thoroughly dry with a clean white cloth. Repeat step until clean cloth shows no evidence of dirt.
 e. Swab area with isopropyl alcohol and allow to dry.
 f. Obtain new harness with adhesive conduit. Remove paper backing to expose adhesive and lightly press into place in the right side fender well.

NOTE

See Figure 7-29. Adhesive conduit should be approximately 0.88 in (22.4 mm) from the chrome base hole and 1.43 in (36.3 mm) from the fender seat screw centerline.

 g. Using a wallpaper seam roller (available at most home improvement stores), work roller over adhesive conduit to purge air from between fender and adhesive. Be aware that most other installation methods will produce unsatisfactory results.
 h. Allow the adhesive 72 hours to fully cure. Installation of the fender may proceed, but exercise caution to avoid pulling or repositioning adhesive conduit.
2. Feed socket housing of rear fender lights connector [7], 8-place Multilock, through hole to outboard side of fender.



1. **Adhesive conduit**
2. **Stud plate**
3. **T-stud cable clips (2)**
4. **Stamped fender clip**
5. **Cable strap**
6. **0.88 in. (22.4 mm) between conduit and chrome base hole**
7. **1.43 in. (36.3 mm) between conduit and fender seat screw centerline**

Figure 7-29. Rear Fender Well

3. Capture rear fender lights harness in channel of stud plate. If loosened, tighten two flange nuts to 60-96 **in-lbs** (6.8-10.9 Nm).
4. See Figure 7-26. Feed socket housing of rear fender lights connector [94] through opening to outboard side of fender. Connect socket housing to pin housing/circuit board.

5. Capture left and right rear turn signal lamp conduit in respective cable clip anchored on T-stud. On FLHX models, also capture license plate lamps conduit in left side cable clip. On FLHR and FLHT/C/U models, capture rear fender tip lamp conduit in both left side cable clip and stamped fender clip.
6. Connect tail lamp connector [93], 4-place Multilock.
7. To avoid stressing wires, verify that tail lamp conduit is positioned on the outboard side of the rear fender tip lamp and left turn signal lamp conduit as shown in Figure 7-25. Place tail lamp into position against chrome base.

NOTE

Over tightening screws can crack the lens or result in scratching of the fender paint.

8. Install two screws and alternately tighten to 20-24 **in-lbs** (2.3-2.7 Nm).
9. Install rear fender. See 2.49 REAR FENDER.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

FENDER TIP LAMPS 7.15

FRONT FENDER TIP LAMP

Removal

1. Insert blade of small screwdriver into slot at top of fender tip lamp lens. Rotate end of screwdriver to unsnap lens from lamp bracket.
2. Holding Keps nuts at inboard side of rear fender, remove two screws to release fender tip lamp bracket.
3. See Figure 7-32. Disconnect front fender tip lamp connector [143], 2-place Multilock.

Installation

1. See Figure 7-32. Connect front fender tip lamp connector [143], 2-place Multilock.
2. With wires routed along bottom left side, place fender tip lamp bracket into position aligning holes in bracket with those in fender.
3. Slide screws through bracket and fender holes and install Keps nuts. Holding nuts at inboard side of fender, tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).

NOTE

Over tightening screws can crack the bracket or result in scratching of the fender paint.

4. Insert tab at bottom of lens into slot of fender tip lamp bracket. Apply thumb pressure at top of lens until it snaps into place.

⚠WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

5. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

FRONT FENDER TIP LAMP JUMPER HARNESS

Removal

1. **FLHR:** Remove headlamp assembly. See 7.11 HEADLAMP: ALL EXCEPT FLTR. Disconnect the front fender tip lamp jumper harness connector [32], 2-place Multilock. See Figure 7-30.
2. **FLHT/C/U:** Reaching in below the fairing cap on the left side of the steering head, disconnect the front fender tip lamp jumper harness connector [32], 2-place Multilock. See Figure 7-31. Remove outer fairing only if necessary. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
3. Draw socket housing down to fender area.
4. Carefully cut cable strap to release front fender tip lamp wires from brake caliper hose.
5. Remove terminals from socket housing.

NOTE

For instructions on removing terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

6. Place the motorcycle on a hydraulic center stand with the front wheel raised off the ground.

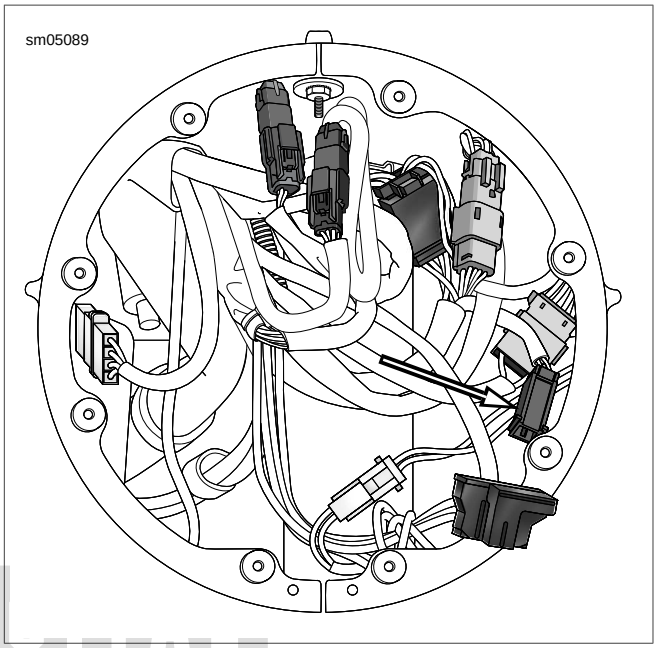


Figure 7-30. Front Fender Tip Lamp Jumper Harness Connector (FLHR)

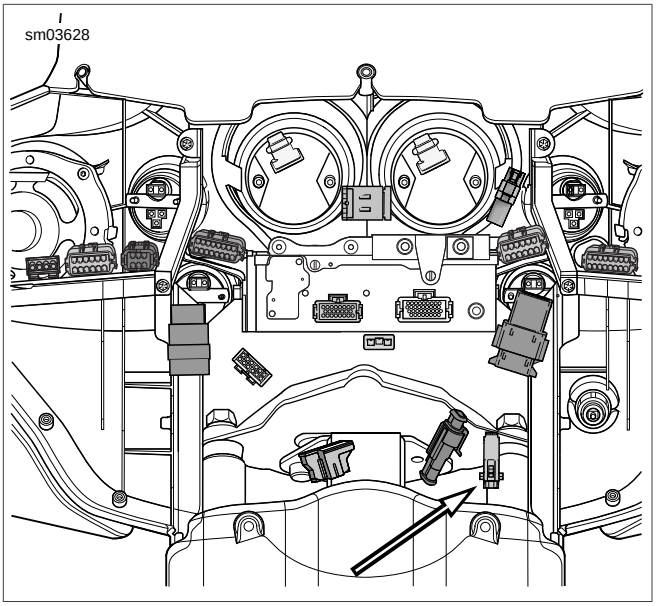
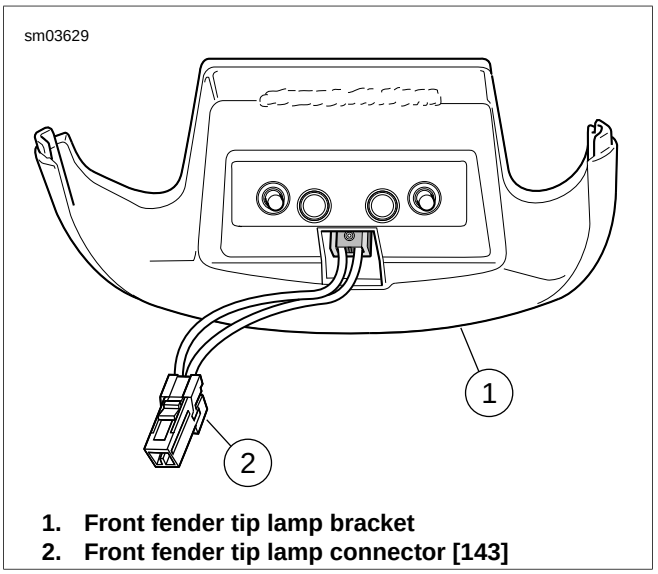


Figure 7-31. Front Fender Tip Lamp Jumper Harness Connector (FLHX, FLHT/C/U)

7. Remove front wheel. See 2.4 FRONT WHEEL.

8. From inboard side of front fender, remove two nuts to release trim strip from left side of fender. See Figure 7-33.
9. Pull wires and socket terminals through grommet to inboard side of fender. See Figure 7-34. Reaching under left side of fender, draw wires forward out from beneath fender bracket.
10. Feed wires through oblong hole to outboard side of fender.



1. **Front fender tip lamp bracket**
2. **Front fender tip lamp connector [143]**

Figure 7-32. Front Fender Tip Lamp Assembly

11. Insert blade of small screwdriver into slot at top of fender tip lamp lens. Rotate end of screwdriver to unsnap lens from lamp bracket.
12. Holding Keps nuts at inboard side of front fender, remove two screws to release fender tip lamp bracket.
13. Disconnect front fender tip lamp connector [143], 2-place Multilock, to release fender tip lamp assembly from jumper harness. See Figure 7-32.

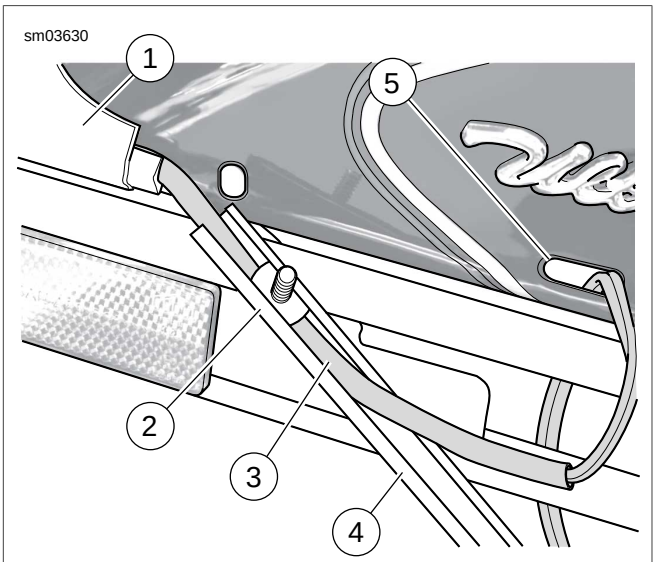
Installation

1. Connect front fender tip lamp connector [143], 2-place Multilock, to attach fender tip lamp assembly to jumper harness. See Figure 7-32.
2. Pull jumper harness conduit as close to fender tip lamp connector [143] as possible, for the conduit is not easily routed beneath the fender bracket.
3. With conduit routed along bottom left side, place fender tip lamp bracket into position aligning holes in bracket with those in fender.
4. Slide screws through bracket and fender holes and install Keps nuts. Holding nuts at inboard side of fender, tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).

NOTE

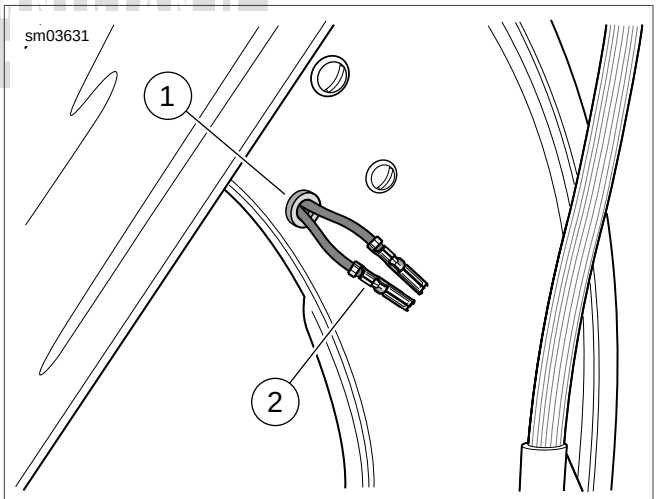
Over tightening screws can crack the bracket or result in scratching of the fender paint.

5. Insert tab at bottom of lens into slot of fender tip lamp bracket. Apply thumb pressure at top of lens until it snaps into place.
6. Route wire conduit inside trim strip and slide front tee bolt over conduit. See Figure 7-33. Verify that second tee bolt is in position at rear of trim strip.



1. **Fender tip lamp bracket**
2. **Tee bolt**
3. **Wire conduit**
4. **Trim strip**
5. **Oblong hole**

Figure 7-33. Install Conduit in Trim Strip



1. **Grommet**
2. **Socket terminals**

Figure 7-34. Pull Fender Tip Lamp Wires and Terminals Through Fender Grommet

7. Feed socket terminals and wires through oblong hole to inboard side of fender.

NOTE

Use the rearmost oblong hole as the front may be used for installation of certain P&A accessories.

8. While removing slack from wires on outboard side of fender, align tee bolts with fender holes. With trim strip

positioned against left side of fender, reach under fender and install nuts on tee bolts. Alternately tighten nuts to 10-15 **in-lbs** (1.1-1.7 Nm).

9. Reaching under left side of fender, route wires of the jumper harness rearward between tee bolt nut and fender bracket and then beneath fender bracket to grommet. See Figure 7-35.

10. Feed socket terminals and wires through grommet to outboard side of fender. See Figure 7-34.

NOTE

If any portion of the jumper harness is above the height of the fender bracket, contact with the tire can cause chafing or other damage. Damage to the wiring can lead to loss of lighting.

11. Remove slack from wires on inboard side of fender. Verify that no portion of the jumper harness is above the height of the fender bracket.

12. Install terminals into socket housing.

NOTE

For instructions on installing terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

13. Route socket housing upward behind chrome skirt (FLHT/C/U) or through bottom of headlamp nacelle (FLHR) to area beneath upper fork bracket. Connect front fender tip lamp jumper harness connector [32].

NOTE

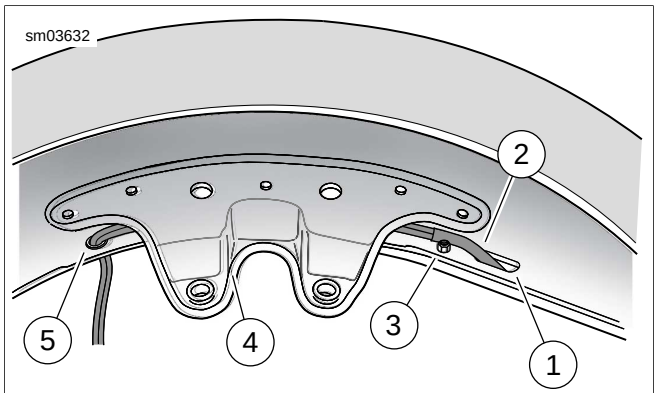
To connect jumper harness connector with the outer fairing installed (FLHT/C/U models), reach in below the fairing cap on the left side of the steering head.

14. Install front wheel. See 2.4 FRONT WHEEL.

15. Install **new** cable strap to secure front fender tip lamp wires to brake caliper hose. See Figure 7-36.

16. **FLHR:** Install headlamp assembly. See 7.11 HEADLAMP: ALL EXCEPT FLTR.

17. **FLHT/C/U:** Install outer fairing, if removed. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.



1. **Oblong hole**
2. **Jumper harness**
3. **T-bolt nut**
4. **Fender bracket**
5. **Grommet**

Figure 7-35. Left Side Front Fender Well

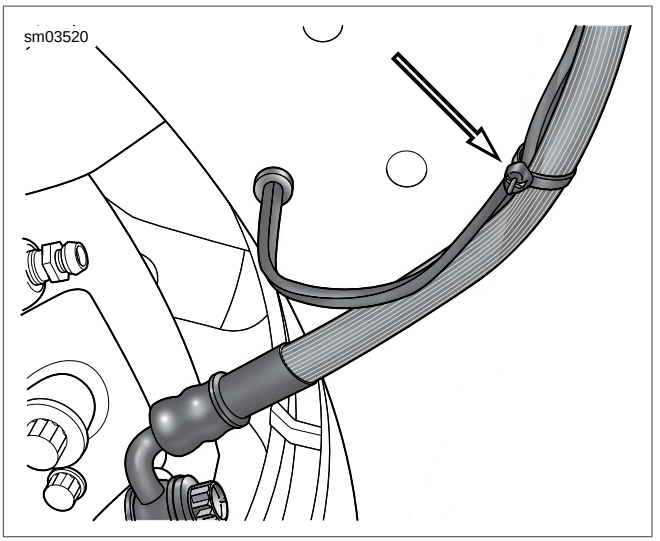


Figure 7-36. Capture Brake Hose and Front Fender Tip Lamp Wires

⚠WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

18. Turn Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

REAR FENDER TIP LAMP

Removal

1. Remove screws to release tail lamp assembly from chrome base.

2. See Figure 7-37. Disconnect tail lamp connector [93] (1). Set tail lamp assembly aside.

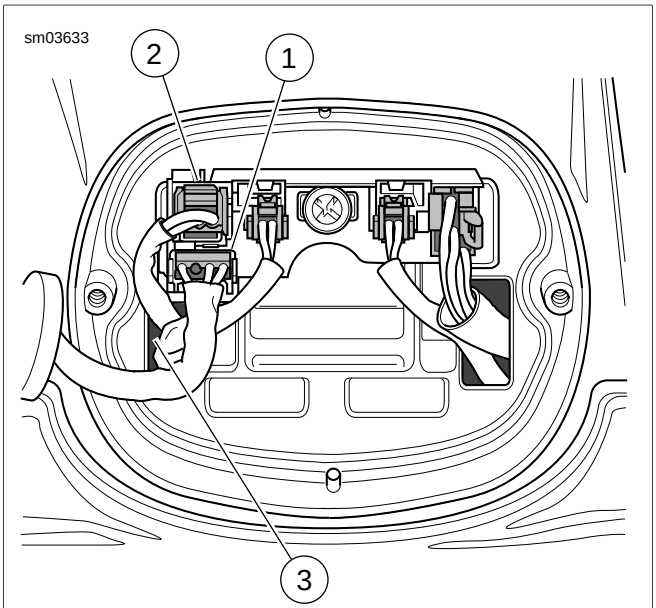
3. Disconnect rear fender tip lamp connector [45] (2).

4. Feed harness through opening (3) in chrome base to inboard side of rear fender.

5. Remove harness from both clips on inner side of fender.

6. See Figure 7-38. Remove two screws (2) from inboard side of fender to release fender tip lamp.

7. Remove fender tip lamp from rear fender.



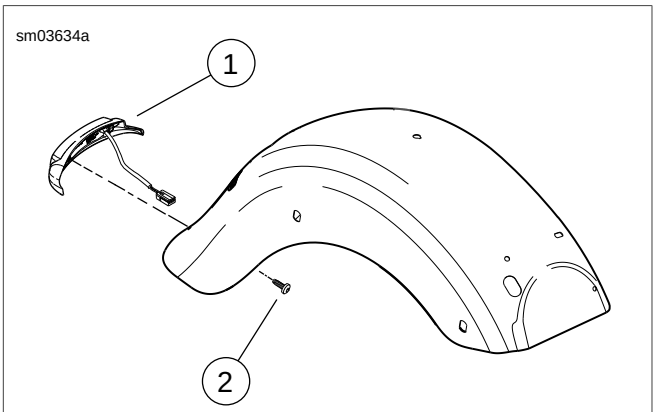
1. **Tail lamp connector [93]**
2. **Rear fender tip lamp connector [45]**
3. **Opening**

Figure 7-37. Depress Button to Release Socket from Pin Housing

4. See Figure 7-37. Attach tail lamp connector [93] (1) to base.
5. Install tail lamp with two screws and tighten to 20-24 **in-lbs** (2.3-2.7 Nm).

NOTE

Over tightening screws can crack the lens or result in scratching of the fender paint.



1. **Fender Tip Lamp**
2. **Screw (2)**

Figure 7-38. Rear Fender Tip Lamp

Installation

1. See Figure 7-37. Route rear fender tip lamp harness through hole at bottom of fender and back through opening (3) in tail lamp base. Attach rear fender tip lamp connector [45] (2).
2. Install rear fender tip lamp harness into both clips on inner side of fender.
3. See Figure 7-38. Place fender tip lamp into position and secure with two screws (2). Tighten to 20-25 **in-lbs** (2.3-2.8 Nm).

WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

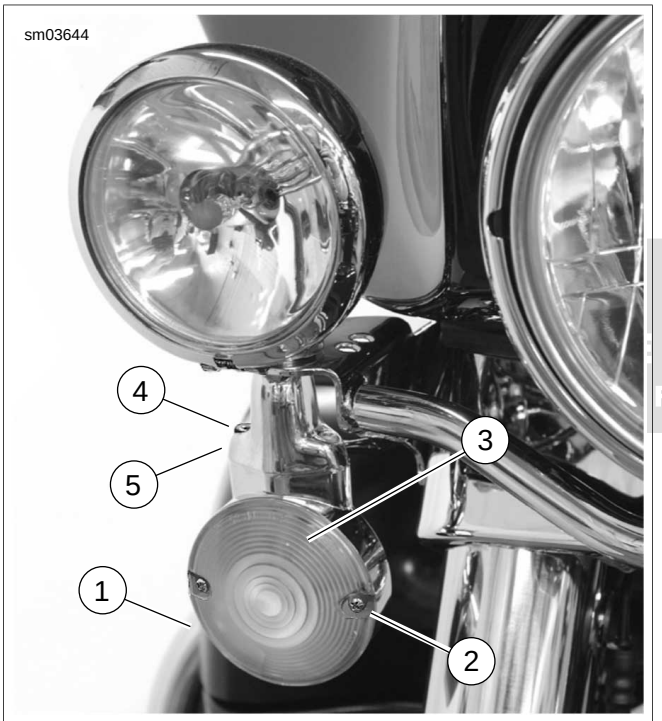
6. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

TURN SIGNAL LAMPS 7.16

BULB REPLACEMENT

Removal

1. Proceed as follows:
 a. **FLHR/C, FLHT/C/U:** See Figure 7-39. Remove two screws to release lens from lamp.
 b. **FLHX, FLTR:** Insert blade of small screwdriver into slot at bottom of lens. Gently rotate end of screwdriver to unsnap lens from lamp.
2. Push in bulb and rotate in a counterclockwise direction to remove.
3. Inspect condition of electrical contacts in socket. If necessary, clean with a small wire brush and electrical contact cleaner.



1. **Turn signal lamp**
2. **Phillips screw (2)**
3. **Lens**
4. **Allen head screw (2)**
5. **Mounting bracket**

Figure 7-39. Front Turn Signal Lamp (FLHR/C, FLHT/C/U)

Installation

1. Liberally apply dielectric grease to contacts in socket and at bottom of **new** bulb. For correct bulb type, see 1.5 BULB REQUIREMENTS.
2. Push in bulb and rotate in a clockwise direction to install.
3. Proceed as follows:
 a. **FLHR/C, FLHT/C/U:** Seat lens in lamp and install two screws.
 b. **FLHX, FLTR:** Seat lens in lamp and gently apply thumb pressure until it snaps into place. Rotate lens to position slot at bottom of lamp.

FRONT TURN SIGNAL LAMP

Removal: FLHR/C, FLHT/C/U

1. **FLHR/C:** See Figure 7-40. Remove headlamp assembly. See 7.11 HEADLAMP: ALL EXCEPT FLTR. Disconnect front turn signal lamps connector [31], 6-place Multilock, anchored in hole of fork stem nut lockplate (left side).
2. **FLHT/C/U:** See Figure 7-41. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U. Disconnect the left or right front turn signal/auxiliary lamp connector [31L/R], 4-place Multilock, on T-stud at top of left or right fairing support brace (outboard side).
3. Remove appropriate terminal(s) from socket housing as follows:

Table 7-8. FLHR/C Front Turn Signal Lamps [31]

LEFT SIDE		RIGHT SIDE	
WIRE COLOR	CHAMBER	WIRE COLOR	CHAMBER
Blue (DOM)	4	Black	1
Violet	5	Brown	2
Black	6	Blue (DOM)	3

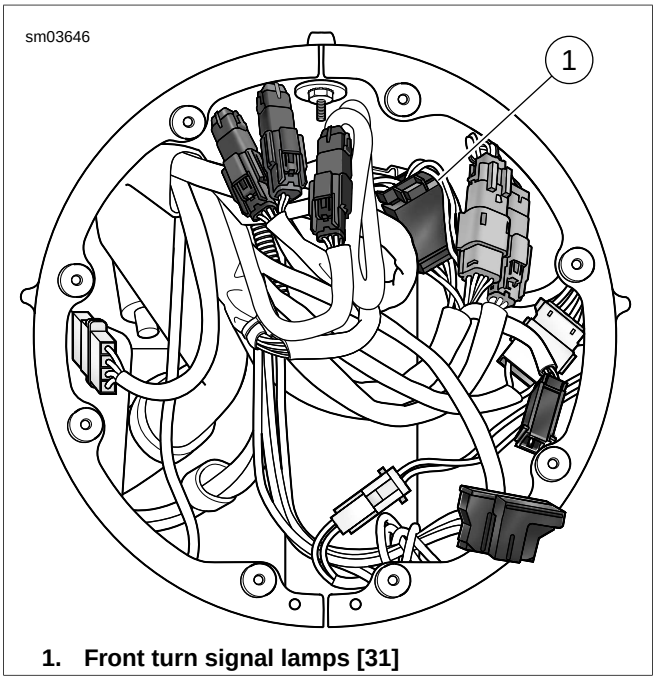
Table 7-9. FLHT/C/U Front Turn Signal Lamps [31L/R]

LEFT SIDE [31L]		RIGHT SIDE [31R]	
WIRE COLOR	CHAMBER	WIRE COLOR	CHAMBER
Blue	1	Blue	1
Violet	2	Brown	2
Black	3	Black	3
Note: Terminal 4 is reserved for the auxiliary lamp.			

NOTE

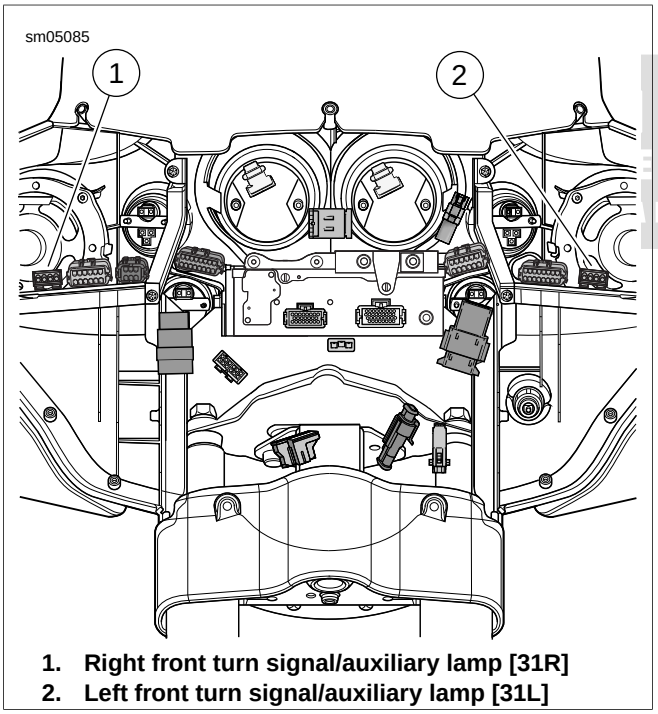
For instructions on removing terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

4. See Figure 7-39. Remove two screws to release turn signal lamp from mounting bracket.
5. See Figure 7-42. Obtain three equal lengths of strong flexible wire for use as mechanics wire. Feed wire through opening in socket terminal and then loop back twisting end until tightly coiled around longer strand. Repeat step with remaining socket terminals.



1. **Front turn signal lamps [31]**

Figure 7-40. Headlamp Nacelle (FLHR/C)



1. **Right front turn signal/auxiliary lamp [31R]**
2. **Left front turn signal/auxiliary lamp [31L]**

Figure 7-41. Inner Fairing (FLHT/C/U)

NOTE

Be sure that mechanics wire is of sufficient strength to pull terminals through conduit without breaking. Wire lengths must also be long enough so that free ends are not lost in conduit when pulled.

6. Carefully pull wires to draw socket terminals through both sections of conduit. For best results, pull one wire at a time.
7. Unravel mechanics wire to release socket terminals.

Installation: FLHR/C, FLHT/C/U

1. Lay old turn signal lamp next to **new** turn signal lamp and cut wires to length.
2. Strip 3/16 in. (4.8 mm) of insulation off lamp wires and crimp on **new** socket terminals.

NOTE

For instructions on crimping terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

3. Reattach mechanics wire to socket terminals and carefully pull ends of mechanics wire to draw socket terminals back through conduit.
4. Carefully remove mechanics wire to avoid damage to terminals.
5. Install terminals into socket housing. For correct terminal locations refer to Table 7-8 or Table 7-9.

NOTE

For instructions on installing terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

6. See Figure 7-39. Start two screws to secure turn signal lamp to mounting bracket. Verify that conduit fits in slot at back of bracket and is not pinched. Alternately tighten screws to 30-60 **in-lbs** (4.1-6.8 Nm).
7. Connect front turn signal/auxiliary lamp connector.
8. **FLHR/C:** See Figure 7-40. Install anchor on connector into hole of fork stem nut lockplate (left side). Install headlamp assembly. See 7.11 HEADLAMP: ALL EXCEPT FLTR.
9. **FLHT/C/U:** Install connector on T-stud at top of left or right fairing support brace (outboard side). Verify that conduit is routed inboard using relief in upper outboard corner of chrome skirt. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

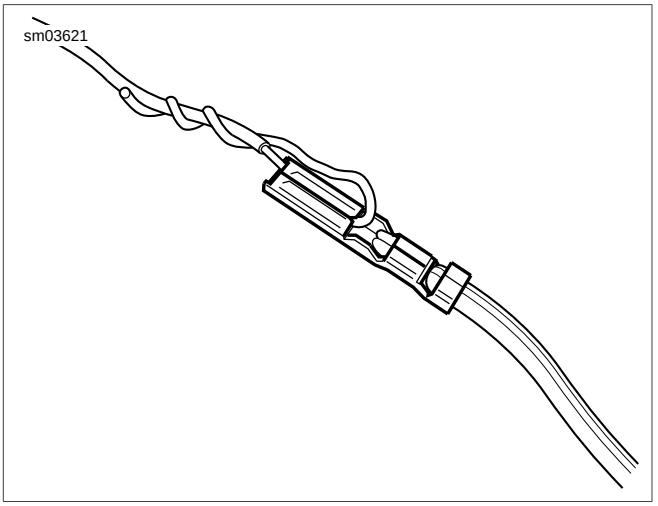


Figure 7-42. Fix Mechanics Wire to Socket Terminal

⚠WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

10. Turn Ignition/Light Key Switch to IGNITION and test for proper operation.

Removal: FLXH

1. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
2. See Figure 7-41. Disconnect the left or right front turn signal lamp connector [31L/R], 4-place Multilock. Connector is attached to T-stud at top of left or right fairing support brace (outboard side).
3. See Figure 7-43. Remove two screws to release turn signal lamp mounting bracket from upper and lower fork brackets.
4. To remove socket/isolator assembly, proceed as follows:
 a. Remove terminals from socket housing.

 NOTE

 For instructions on removing terminals, see A.1 AMP MULTILOCK CONNECTORS.

 b. Pull mounting bracket from conduit.
 c. Insert blade of small screwdriver into slot at bottom of lens. Gently rotate end of screwdriver to unsnap lens from lamp.
 d. Push in bulb and rotate counterclockwise to remove.
 e. Inserting blade of small screwdriver between outer edge of rubber isolator and inside of lamp housing, gently pry up socket assembly until free.
 f. Pull socket assembly to draw conduit and terminals into lamp and then out through lens opening.
 g. Remove rubber isolator from lamp if still installed.

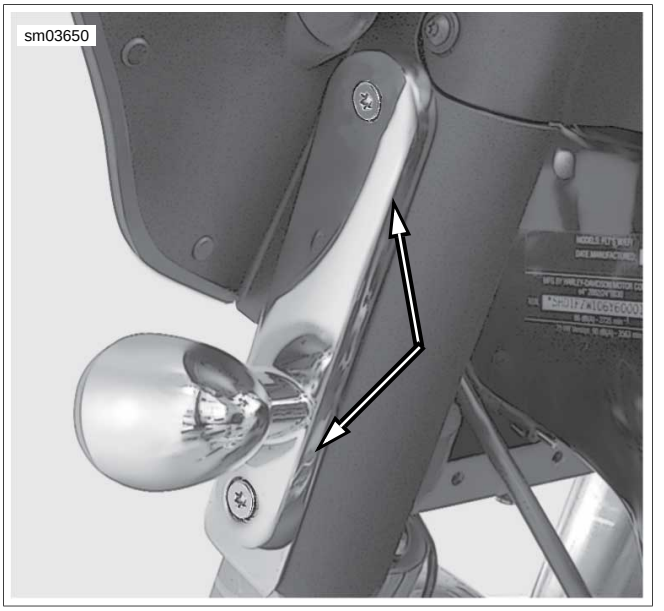


Figure 7-43. Front Turn Signal Lamp (FLHX)



Figure 7-44. Route Conduit Through Mounting Bracket and Chrome Skirt Reliefs (FLHX)

Installation: FLHX

NOTE

If turn signal lamp is already assembled, begin procedure at step 2.

1. To install socket/isolator assembly, proceed as follows:
 a. Seat socket assembly in rubber isolator aligning tab on socket with slot in isolator.
 b. Feed terminals and conduit into lamp through lens opening and then out through unthreaded hole.
 c. Install socket assembly aligning tab on socket with slot inside lamp.
 d. Using thumbs of both hands, apply even pressure around outer edge of socket assembly until fully seated.
 e. Liberally apply dielectric grease to contacts in socket and at bottom of bulb. Push in bulb and rotate clockwise to install.
 f. Install lens in lamp and gently apply thumb pressure until it snaps into place. Rotate lens to position slot at bottom of lamp.
 g. Feed terminals and conduit through triangular shaped hole in mounting bracket.
 h. Align thru hole in mounting bracket with threaded hole in lamp and start hex screw. Tighten hex screw to 15-20 ft-lbs (20-27 Nm).

 NOTE

 For instructions on installing terminals, see A.1 AMP MULTILOCK CONNECTORS.

 i. Install terminals into socket housing as follows:

Table 7-10. FLHX, FLTR Front Turn Signal Lamps [31L/R]

LEFT SIDE [31L]		RIGHT SIDE [31R]	
WIRE COLOR	CHAMBER	WIRE COLOR	CHAMBER
Blue	1	Blue	1
Violet	2	Brown	2
Black	3	Black	3
Empty	4	Empty	4

2. Start two screws to fasten turn signal lamp mounting bracket to upper and lower fork brackets.
3. See Figure 7-44. To avoid pinching wires, verify that conduit is routed forward through relief at front of mounting bracket, and then inboard using relief in upper outboard corner of chrome skirt.
4. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm).
5. See Figure 7-41. Connect front turn signal lamp connector. Install connector on T-stud at top of left or right fairing support brace (outboard side).
6. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

Removal: FLTR

1. See Figure 7-45. Remove outer fairing and front turn signal lamp. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
2. To remove socket/isolator assembly, proceed as follows:
 a. Remove terminals from socket housing.

 NOTE

 For instructions on removing terminals, see A.1 AMP MULTILOCK CONNECTORS.

 b. Pull lamp from mounting bracket.
 c. Insert blade of small screwdriver into slot at bottom of lens. Gently rotate end of screwdriver to unsnap lens from lamp.
 d. Push in bulb and rotate counterclockwise to remove.
 e. Inserting blade of small screwdriver between outer edge of rubber isolator and inside of lamp housing, gently pry up socket assembly until free.
 f. Pull socket assembly to draw conduit and terminals into lamp and then out through lens opening.
 g. Remove rubber isolator from lamp if still installed.

Installation: FLTR

NOTE

If turn signal lamp is already assembled, begin procedure at step 2.

1. Assemble front turn signal lamp as follows:
 a. Seat socket assembly in rubber isolator aligning tab on socket with slot in isolator.
 b. Feed terminals and conduit into lamp through lens opening and then out through unthreaded hole.
 c. Install socket assembly aligning tab on socket with slot inside lamp.
 d. Using thumbs of both hands, apply even pressure around outer edge of socket assembly until fully seated.
 e. Liberally apply dielectric grease to contacts in socket and at bottom of bulb. Push in bulb and rotate clockwise to install.
 f. Install lens in lamp and gently apply thumb pressure until it snaps into place. Rotate lens to position slot at bottom of lamp.
 g. See Figure 7-45. Install lamp onto mounting bracket.

 NOTE

 For instructions on installing terminals, see A.1 AMP MULTILOCK CONNECTORS.

 h. Install terminals into socket housing. For correct terminal locations refer to Table 7-10.
2. Install outer fairing and front turn signal lamp. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.

WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

3. Turn Ignition/Light Key Switch to IGNITION and test for proper operation.

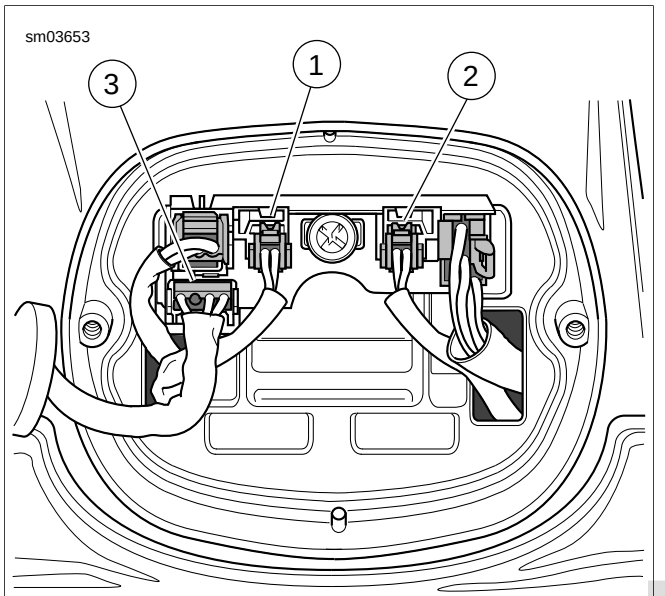


Figure 7-45. Front Turn Signal Lamp (FLTR)

REAR TURN SIGNAL LAMP

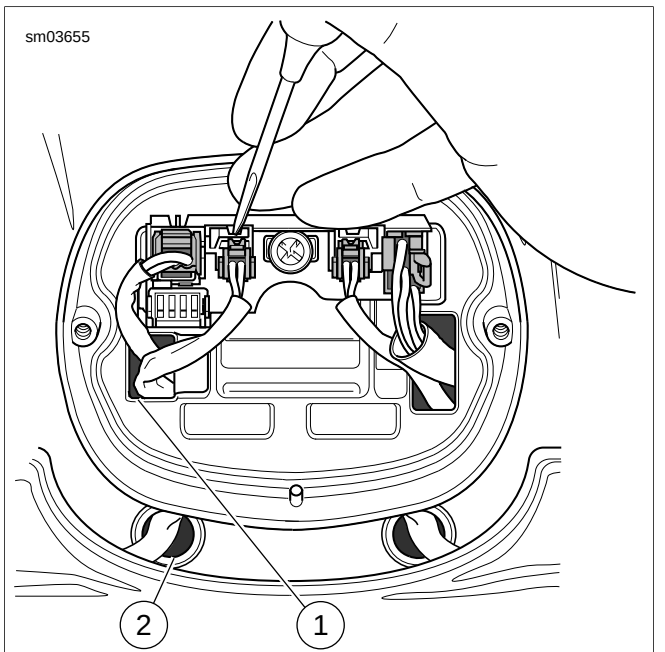
Removal: FLHR/C, FLHT/C/U

1. Remove saddlebag on same side of motorcycle. See 2.29 SADDLEBAGS.
2. Remove two screws to release tail lamp assembly from chrome base.



1. **Left turn signal lamp [18]**
2. **Right turn signal lamp [19]**
3. **Tail lamp [93]**

Figure 7-46. Release Tail Lamp Socket



1. **Opening**
2. **Fender hole**

Figure 7-47. Use Pick Tool to Release Left Turn Signal Lamp Socket

3. See Figure 7-46. Disconnect tail lamp connector [93], 4-place Multilock. Set tail lamp assembly aside.
4. See Figure 7-47. Disconnect turn signal lamp assembly, 2-place Multilock. For best results, use a pick or small screwdriver to press release button.
5. Feed socket housing through opening in chrome base to inboard side of rear fender.
6. Reaching under rear fender, release conduit from cable clip anchored on T-stud.
7. See Figure 7-47. Draw conduit and socket housing out through fender hole just below chrome base.
8. Draw socket housing through channel on inboard side of rear turn signal lamp bracket, so that length of conduit hangs below turn signal lamp.
9. Inserting a long shank ball end socket (Snap-on® FABL5) through channel in bracket, remove two screws to release turn signal lamp assembly.
10. Remove terminals from socket housing.

NOTE

For instructions on removing terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

Installation: FLHR/C, FLHT/C/U

1. Place **new** turn signal lamp assembly next to discarded unit and cut wires to proper length.
2. Crimp **new** socket terminals onto turn signal lamp wires.

NOTE

For instructions on crimping terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

3. Install terminals into socket housing.

Table 7-11. Rear Turn Signal Lamps [18/19]

WIRE COLOR	CHAMBER NUMBER
Violet/Brown	1
Black	2

NOTE

For instructions on installing terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

4. Align holes in turn signal lamp assembly with those in rear turn signal lamp bracket and start two screws. For best results, insert a long shank ball end socket (Snap-on® FABL5) through channel on inboard side of bracket. Alternately tighten screws to 30-50 **in-lbs** (3.4-5.6 Nm).
5. See Figure 7-47. Route socket housing through channel in bracket, and then feed through fender hole just below chrome base.
6. Reaching under rear fender, capture conduit in cable clip anchored on T-stud.
7. Feed socket housing through opening in chrome base to outboard side of rear fender.

8. Orient socket housing so that the release button is at the top and insert into pin housing/circuit board.
9. See Figure 7-46. To install tail lamp assembly, orient 4-place Multilock socket so that the release button is at the bottom and insert into pin housing until it "clicks." To avoid stressing wires, verify that tail lamp conduit is positioned on the outboard side of the rear fender tip lamp and left turn signal lamp conduit.
10. Place tail lamp into position against chrome base.
11. Install two screws and alternately tighten to 20-24 **in-lbs** (2.3-2.7 Nm).

NOTE

Over tightening screws can crack the lens or result in scratching of the fender paint.

12. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.
13. Install saddlebag. See 2.29 SADDLEBAGS.

Removal: FLHX, FLTR

NOTE

This procedure entails replacement of the rear turn signal lamp socket/ isolator assembly. To remove and install the turn signal lamps bracket, see 7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket.

1. Remove chrome base and circuit board assembly. See 7.14 TAIL LAMP.
2. Remove terminals from socket housing of rear turn signal lamp connector.

NOTE

For instructions on removing terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

3. Reaching inside rear fender, release conduit from cable clip anchored on T-stud.
4. Draw conduit and terminals through hole to outboard side of fender.
5. Remove socket/isolator assembly as follows:
 a. Insert blade of small screwdriver into slot at bottom of lens. Gently rotate end of screwdriver to unsnap lens from lamp.
 b. Push grommet at end of conduit into lamp housing. Lightly lubricate grommet with glass cleaner, if necessary.
 c. Push in bulb and rotate in a counterclockwise direction to remove.
 d. Inserting blade of small screwdriver between outer edge of rubber isolator and inside of lamp housing, gently pry up socket assembly until free.
 e. Pull socket assembly to draw conduit and terminals into lamp and then out through lens opening.
 f. Remove rubber isolator from lamp if still installed.

Installation: FLHX, FLTR

1. Place **new** socket/isolator assembly next to discarded unit and cut wires to proper length. Crimp new socket terminals onto wires.

NOTE

For instructions on crimping terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

2. Install socket/isolator assembly as follows:
 a. Seat socket assembly in rubber isolator aligning tab on socket with slot in isolator.
 b. Feed terminals and conduit into lamp through lens opening and then out through unthreaded hole.
 c. Exercising caution to avoid pulling on wires, carefully pull grommet out through hole in lamp. For best results, grasp edge of grommet with needle nose pliers. Lightly lubricate grommet with glass cleaner, if necessary.
 d. Install socket assembly aligning tab on socket with slot inside lamp.
 e. Using thumbs of both hands, apply even pressure around outer edge of socket assembly until fully seated.
 f. Liberally apply dielectric grease to contacts in socket and at bottom of bulb. Push in bulb and rotate in a clockwise direction to install.
 g. Install lens in lamp and gently apply thumb pressure until it snaps into place. Rotate lens to position slot at bottom of lamp.
3. Feed socket terminals through hole to inboard side of fender.
4. Install terminals into socket housing. See Table 7-11.

NOTE

For instructions on installing terminals, see A.1 AMP MULTI-LOCK CONNECTORS.

5. Reaching inside rear fender, capture conduit in cable clip anchored on T-stud.
6. Install chrome base and circuit board assembly. See 7.14 TAIL LAMP.

REAR TURN SIGNAL LAMPS BRACKET

Removal: FLHR/C, FLHT/C/U

1. Remove chrome base and circuit board assembly. See 7.14 TAIL LAMP.
2. Remove rear turn signal lamps from bracket. See 7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamp in this section.
3. If equipped with license plate lamp on turn signal bracket, remove terminals from license plate lamp connector. See A.1 AMP MULTILOCK CONNECTORS.
4. Remove two screws to free rear turn signal lamps bracket from rear fender.

5. If equipped with license plate lamp on turn signal bracket, remove license plate bracket and lamp.

Installation: FLHR/C, FLHT/C/U

1. If equipped with license plate lamp on turn signal bracket, install license plate lamp and bracket. Tighten license plate bracket screws to 60-80 **in-lbs** (6.8-9.0 Nm).
2. Apply one drop of Loctite High Strength Threadlocker 271 (red) to two screws.
3. Install screws to fasten rear turn signal lamps bracket to rear fender. Alternately tighten screws to 84-144 **in-lbs** (9.5-16.3 Nm).
4. If equipped with license plate lamp on turn signal bracket, route wires through hole in fender and install terminals into license plate lamp connector. See A.1 AMP MULTI-LOCK CONNECTORS. Also refer to Table 7-12.
5. Install rear turn signal lamps to bracket. See 7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamp in this section.
6. Install chrome base and circuit board assembly. See 7.14 TAIL LAMP.

Removal: FLHX, FLTR

1. Remove circuit board and chrome base. See 7.14 TAIL LAMP.
2. Reaching inside rear fender, release left and right rear turn signal lamp conduit from respective cable clips anchored on T-studs.
3. Remove terminals from license plate lamp connector. See A.1 AMP MULTILOCK CONNECTORS.
4. Remove two screws to release rear turn signal lamps bracket.
5. Pull rear turn signal lamps bracket away from motorcycle drawing socket housings out through fender holes.
6. Remove license plate bracket and lamp from turn signal bracket.

Installation: FLHX, FLTR

1. Install license plate lamp and bracket onto turn signal bracket. Tighten license plate bracket screws to 60-80 **in-lbs** (6.8-9.0 Nm).
2. Feed socket housings of left and right rear turn signal lamps and license plate wire terminals through respective holes to inboard side of fender.
3. Apply one drop of Loctite High Strength Threadlocker 271 (red) to two screws.
4. Install screws to fasten rear turn signal lamps bracket to rear fender. Alternately tighten screws to 84-144 **in-lbs** (9.5-16.3 Nm).
5. Install terminals into license plate lamp connector. See A.1 AMP MULTILOCK CONNECTORS. Also refer to Table 7-12.
6. Install chrome base and circuit board assembly. See 7.14 TAIL LAMP.

Table 7-12. License Plate Lamp Connector [45]

WIRE COLOR	CHAMBER NUMBER
Black	1
Not Used	2
Black	3

DIGITAL TECHNICIAN HARLEY-DAVIDSON

REMOVAL

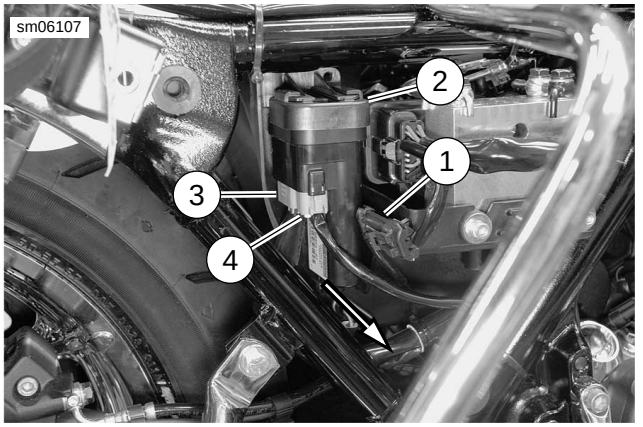
NOTE

If equipped with the optional "Harley-Davidson Smart Security System," verify that the security status lamp in speedometer face is not flashing before proceeding (security system disarmed).

1. With the ignition key ON and the security fob present, remove the main fuse.
2. Remove left saddlebag and left side cover.
3. See Figure 7-48. If equipped with ABS, release rear ABS wheel speed sensor connector (1) from battery tray.
4. Pull out on bottom of module to release from retainer in battery tray.
5. Remove module from upper retainer (2) and disconnect TSM/HFSM connector (3) and HFSM antenna jumper harness connector (4) if equipped.

INSTALLATION

1. See Figure 7-48. Connect TSM/HFSM connector (3) and HFSM antenna jumper harness connector (4) if equipped.
2. Install module into upper retainer (2) and push bottom of module until it is secure in the retainer on the battery tray.
3. If equipped, secure rear wheel speed sensor connector (1) to retainer.
4. Install right side cover and saddle bag.
5. Test all turn signal functions. Test all security system functions, if equipped.



1. **Rear wheel speed sensor connector**
2. **Upper retainer**
3. **TSM/HFSM connector**
4. **HFSM antenna jumper harness connector**

Figure 7-48. TSM/HFSM Module

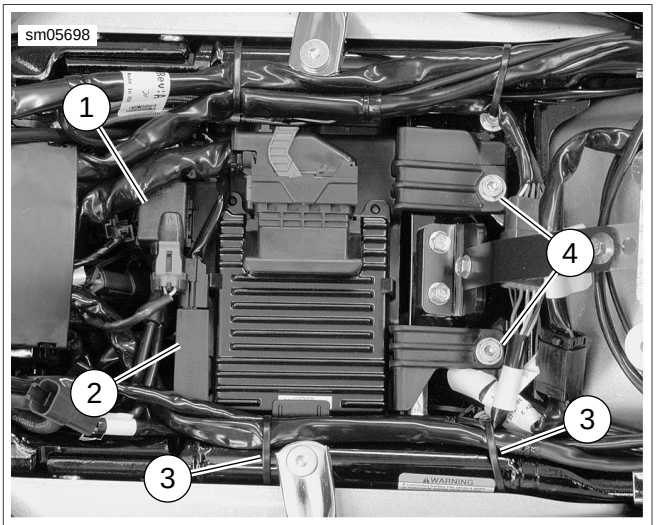
HFSM ANTENNA

Removal

1. Remove seat. See 2.28 SEAT.
2. See Figure 7-49. Release HFSM antenna (2) from top caddy.
3. Disconnect HFSM antenna jumper harness.
4. If necessary, remove HFSM antenna jumper harness as follows:
 a. Remove HFSM module and disconnect antenna jumper harness. See 7.17 TSM/HFSM, Removal.
 b. Cut cable strap retaining jumper harness and main harness to rear downtube.
 c. Remove jumper harness through right side opening.

Installation

1. Install HFSM antenna jumper harness as follows:
 a. Feed jumper harness down ahead of battery tray and out through right side opening.
 b. Route jumper harness under ABS mounting area of battery tray to the TSM/HFSM module.
 c. Connect jumper harness connector to HFSM module and install HFSM module. See 7.17 TSM/HFSM, Installation.
 d. Secure antenna harness and main harness to down tube using a **new** cable strap.
2. See Figure 7-49. Connect HFSM antenna (2) to jumper harness.
3. Engage groove on HFSM antenna on tongue at front of top caddy.
4. Install seat. See 2.28 SEAT.
5. Test all security system functions.



1. **Purge solenoid**
2. **HFSM antenna**
3. **Cable ties**
4. **Fastener**

Figure 7-49. Top Caddy

IGNITION/LIGHT KEY SWITCH AND FORK LOCK 7.18

FLHX, FLHT/C/U, FLTR

PART NUMBER	TOOL NAME
HD-45961	IGNITION SWITCH CONNECTOR REMOVER
HD-45962	IGNITION SWITCH ALIGNMENT TOOL

Removal

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Remove the ignition switch knob as follows:
 a. Insert the ignition switch key and turn to the UNLOCK position. Leave the key installed in the ignition switch knob.
 b. Turn the front forks to the left fork stop and rotate the knob to FORK LOCK.
 c. See Figure 7-50. Pressing the release button at bottom (left side) with a small screwdriver, push key down and turn 60 degrees in a counterclockwise direction.

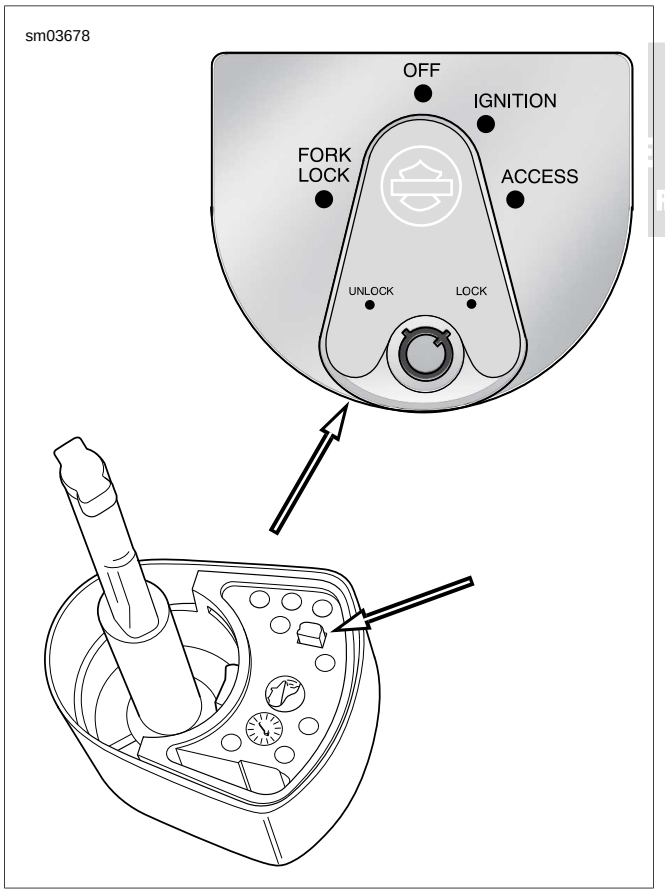


Figure 7-50. Ignition Switch Knob Release Button (Top and Bottom Views)

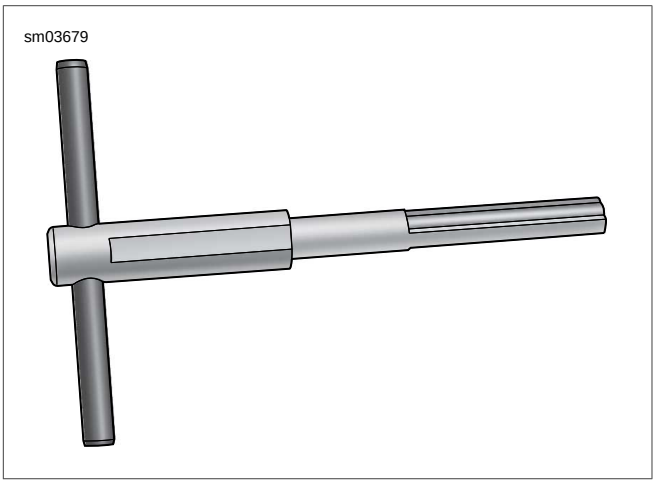


Figure 7-51. Ignition Switch Alignment Tool (HD-45962)

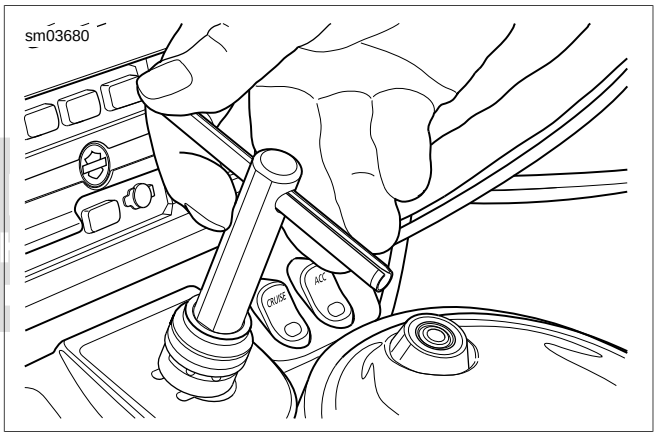


Figure 7-52. Bottom Alignment Tool in Threaded Post and Rotate to Desired Position

3. Lift and remove knob. Be aware that spring will drop out of bore at underside of knob when removed.

NOTE

See Figure 7-52. After removal of the knob, the IGNITION SWITCH ALIGNMENT TOOL (Part No. HD-45962) may be used to move the switch to other positions as required. Insert tool until bottom of handle contacts top of threaded post, and then rotate handle in a clockwise direction to the selected position.

4. Turn the front forks to the right fork stop, and using a 7/8 inch open end/box wrench on flats, remove nut from threaded post of ignition switch housing.
5. Pull collar and spacer from threaded post.
6. Remove the switch position plate by pulling tabs from slots in fairing cap (FLHX, FLHT/C/U) or instrument nacelle (FLTR).

7. **FLHX, FLHT/C/U:**
 a. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
 b. Using a long shank ball end socket (Snap-on® FABL6E), remove four socket head screws to release radio (storage box on FLHT) from left and right radio support brackets. Use oblong holes in fairing brackets to access screws. Lift radio slightly.
 c. Carefully cut anchored cable strap to release main harness conduit from bottom right corner of radio.
 d. Remove fairing cap. See 2.38 FAIRING CAP: FLHX, FLHT/C/U.
8. **FLTR:** Remove instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.
9. Disconnect ignition switch connector [33], 3-place Packard, at front of ignition switch housing. Proceed as follows:
 a. See Figure 7-53. Obtain the IGNITION SWITCH CONNECTOR REMOVER (Part No. HD-45961).
 b. Gently insert end of tool into slot in ignition switch housing until it stops.
 c. See Figure 7-54. Grasping main harness conduit and tool, pull both at the same time to release socket housing from ignition switch housing.

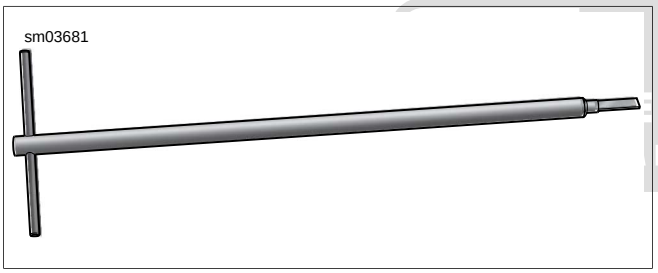


Figure 7-53. Ignition Switch Connector Remover (HD-45961)

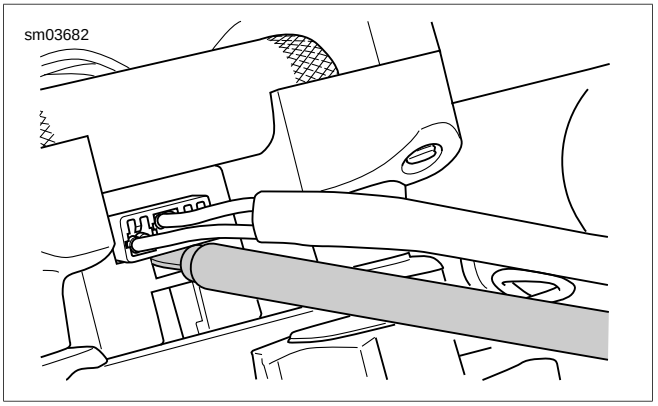
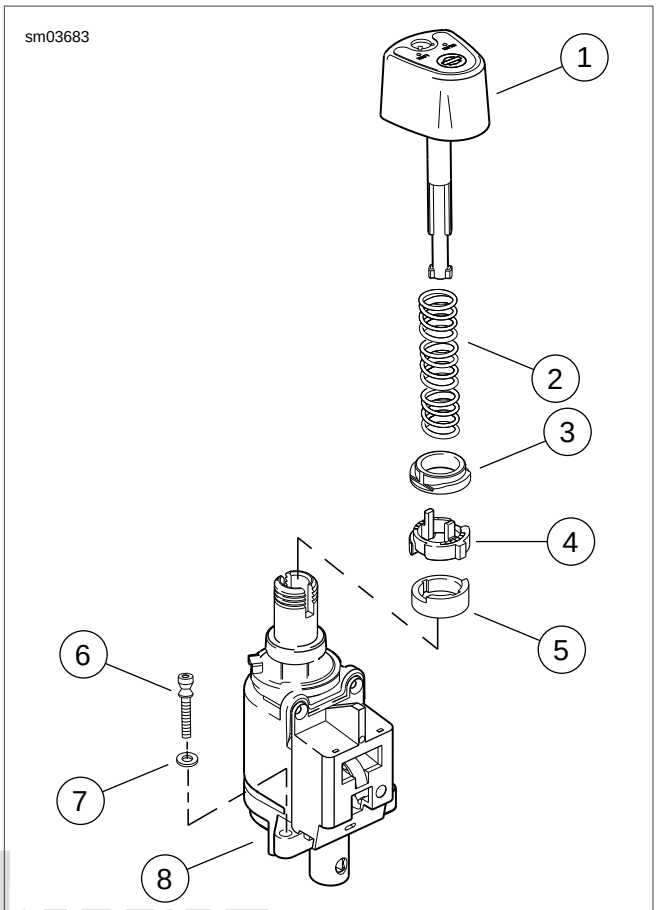


Figure 7-54. Pull Main Harness Conduit and Tool to Release Socket Housing



1. **Knob**
2. **Spring**
3. **Nut**
4. **Collar**
5. **Spacer**
6. **Break-away screw (international only)**
7. **Flat washer**
8. **Switch housing**

Figure 7-55. Ignition Switch Assembly (International)

10. Remove upper handlebar clamp. Support handlebars out of the way. See 2.26 HANDLEBARS, Removal.
11. **Domestic:** Remove two screws (with flat washers) at base of ignition switch housing.

⚠CAUTION

Always wear proper eye protection when drilling or grinding. Flying debris could cause serious eye injury. (00402e)

12. **International:** Remove two break-away screws (with flat washers) as follows.
 a. Use a center punch to make a pilot hole at the top of each break-away screw.
 b. Install a 1/8 inch left handed bit in drill and set the drill to Reverse. Positioning the bit in the pilot hole, spin out the break-away screws.

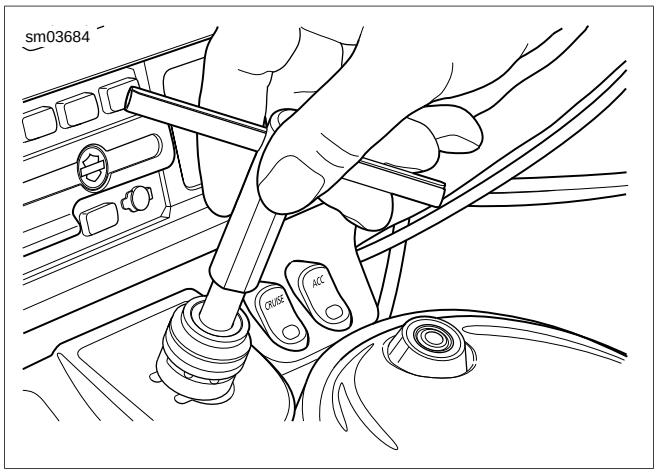


Figure 7-56. Rotate Alignment Tool Without Bottoming

NOTE

If the above method fails, use a 3/16 inch bit with long shank to carefully drill off heads of break-away screws. Use a pliers to unthread the shafts from the upper fork bracket.

13. See Figure 7-55. Remove ignition switch housing from bore of upper fork bracket.

Installation

1. Slide base of ignition switch housing into bore of upper fork bracket.
2. **Domestic:** Install two screws (with flat washers) at base of ignition switch housing. Alternately tighten screws to 36-60 **in-lbs** (4.1-6.8 Nm).
3. **International:** Install two **new** break-away screws (with flat washers) as follows.
 a. Verify that the threads in the upper fork bracket are clean and in good condition. Dirty and/or damaged threads may cause the heads of the break-away screws to snap off before the switch housing is properly tightened.

 NOTE

 Exercise care to avoid losing heads of break-away screws in motorcycle. Vibration may cause captured heads to scratch finished surfaces, chafe wires or cause other damage.

 b. Rotate break-away screws in a clockwise direction until heads snap off.
4. Install handlebars. See 2.26 HANDLEBARS, Installation.
5. Install ignition switch connector [33], 3-place Packard, at front of ignition switch housing.
6. Install anchor of **new** cable strap in hole at bottom right side of radio. Tighten cable strap capturing main harness conduit (to ignition switch).
7. **FLHX, FLHT/C/U:**
 a. Install fairing cap. See 2.38 FAIRING CAP: FLHX, FLHT/C/U.
 b. Using oblong holes in fairing brackets and a long shank ball end socket (Snap-on® FABL6E), install four socket head screws to fasten radio (storage box on FLHT) to left and right radio support brackets. Alternately tighten screws to 35-45 **in-lbs** (4.0-5.1 Nm).
 c. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
8. **FLTR:** Install instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.
9. Install switch position plate fitting tabs in slots of fairing cap (FLHX, FLHT/C/U) or instrument nacelle (FLTR). Plate snaps in place when properly installed. Exercise care to avoid breaking tabs. Replace plate if tabs are damaged.
10. See Figure 7-55. Install spacer over threaded post of ignition switch housing until it contacts switch position plate. Orient spacer so that the widest side is forward and the inside tabs fit in slots of post.
11. Slide collar over threaded post until it contacts spacer. Orient collar so that the outside tab is forward and the inside tabs fit in slots of post.
12. Thread nut onto post with the lipped side down and the smaller OD topside. Turn the front forks to the right fork stop, and using a 7/8 inch Open End Crow Foot on flats, tighten nut to 125-150 **in-lbs** (14.1-16.9 Nm).
13. Install spring into bore at underside of knob.
14. With the knob pointing toward the FORK LOCK position, insert shaft into threaded post. Holding the knob down, turn key clockwise to UNLOCK. An audible "click" should be heard when knob and switch are properly engaged. Release knob and then rotate through all four switch positions to verify proper operation. If knob will not install properly, proceed as follows:
 a. See Figure 7-50. Verify that button at bottom of knob is pressed and key is turned 60 degrees beyond the UNLOCK position.
 b. Repeat this step.
 c. If knob does not install properly, move to previous step.
15. Knob was removed in ACCESS or switch may have been moved out of the FORK LOCK position. Proceed as follows:
 a. See Figure 7-52. Insert alignment tool until bottom of handle contacts top of threaded post, and holding front forks at the left fork stop, rotate handle of tool in a counter-clockwise direction until fork locks.
 b. Remove tool and repeat previous step.
 c. If knob does not install properly, move to next step.
16. Detent and switch position lugs are misaligned. This can occur when the alignment tool (or ignition switch knob) is

rotated before it is properly bottomed in the ignition switch housing. Proceed as follows:

a. Reinstall knob inserting shaft into threaded post and gently rotate knob until it drops into the partially installed position. Take note of the position of the knob, that is, whether it is pointing toward the rear, or to ACCESS, IGNITION or OFF.

b. See Figure 7-56. Remove knob and insert alignment tool so that the bottom of the handle is approximately 0.500-0.0750 in. (12.7-19.1 mm) from the top of the threaded post, and then hold.

c. Rotate alignment tool in a counter-clockwise direction the number of positions needed to get to FORK LOCK. For example, if the knob dropped into the partially installed position at IGNITION in step 16(a), rotate the alignment tool two positions in a counter-clockwise direction. Or if the knob was pointing toward the rear when it dropped, rotate the alignment tool four positions in a counterclockwise direction or one position in a clockwise direction. Repeat step 14.

17. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

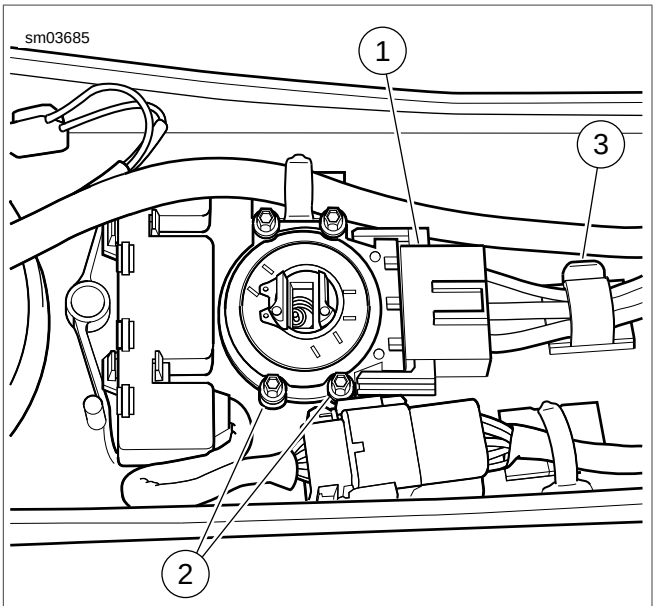
FLHR/C

Ignition/Light Key Switch: Removal

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Remove seat. See 2.28 SEAT.
3. Remove socket screw to release front of console from fuel tank weldment.
4. Remove hex screw to release rear console bracket from clip nut on rear fuel tank bracket.
5. Lay a clean shop towel on forward part of rear fender. Remove console and lay upside down on shop towel.
6. See Figure 7-57. Disconnect ignition switch connector [33], 3-place Packard. Release ignition switch conduit from plastic clip, if necessary.
7. Remove four screws to release ignition switch from console.

Ignition/Light Key Switch: Installation

1. See Figure 7-57. Align holes in **new** ignition switch with those in console.
2. Start four screws and alternately tighten to 20-30 **in-lbs** (2.3-3.4 Nm) in a crosswise pattern.
3. Connect ignition connector [33], 3-place Packard. Capture ignition switch conduit in plastic clip, if removed.
4. Exercising caution to avoid pinching wire harness and vent tube, position console on fuel tank.
5. Start socket screw to fasten front of console to fuel tank weldment.



1. **Ignition switch connector [33]**
2. **Screw (4)**
3. **Plastic clip**

Figure 7-57. Instrument Console (FLHR/C)

6. Start hex screw to fasten rear console bracket to clip nut on rear fuel tank bracket.
7. Alternately tighten socket/hex screws to 36-60 **in-lbs** (4.1-6.8 Nm).
8. Install seat. See 2.28 SEAT.
9. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

Fork Lock: Removal

1. Remove handlebar clamp shroud. See 2.47 HEADLAMP NACELLE: FLHR/C, steps 1-11.
2. Start acorn nuts on both the left and right side fork bracket studs to keep halves of headlamp nacelle on motorcycle.
3. See Figure 7-58. Remove two socket screws (with flat washers) and pull fork lock assembly from upper fork bracket bore.

NOTE

On HDI models, use a center punch to make a pilot hole at the top of each break-away screw. Install a 1/8 inch left handed bit in drill and set the drill to reverse. Positioning the bit in the pilot hole, spin out the break-away screws.

Fork Lock: Installation

1. See Figure 7-58. Install **new** fork lock assembly into bore of upper fork bracket.
2. Install two socket screws (with flat washers) and alternately tighten to 36-60 **in-lbs** (4.1-6.8 Nm).

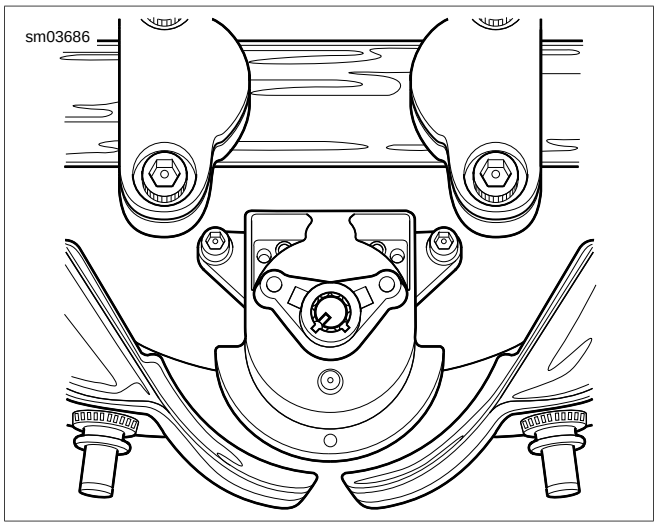


Figure 7-58. Fork Lock (FLHR/C)

NOTE

On HDI models, install new break-away screws and turn in a clockwise direction until heads snap off. Verify that threads in upper fork bracket are clean and in good condition or heads may break off before fork lock assembly is properly tightened. Avoid losing heads of screws in motorcycle as vibration may cause captured heads to scratch finished surfaces, chafe wires or cause other damage.

3. Install handlebar clamp shroud. See 2.47 HEADLAMP NACELLE: FLHR/C, steps 3-15.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

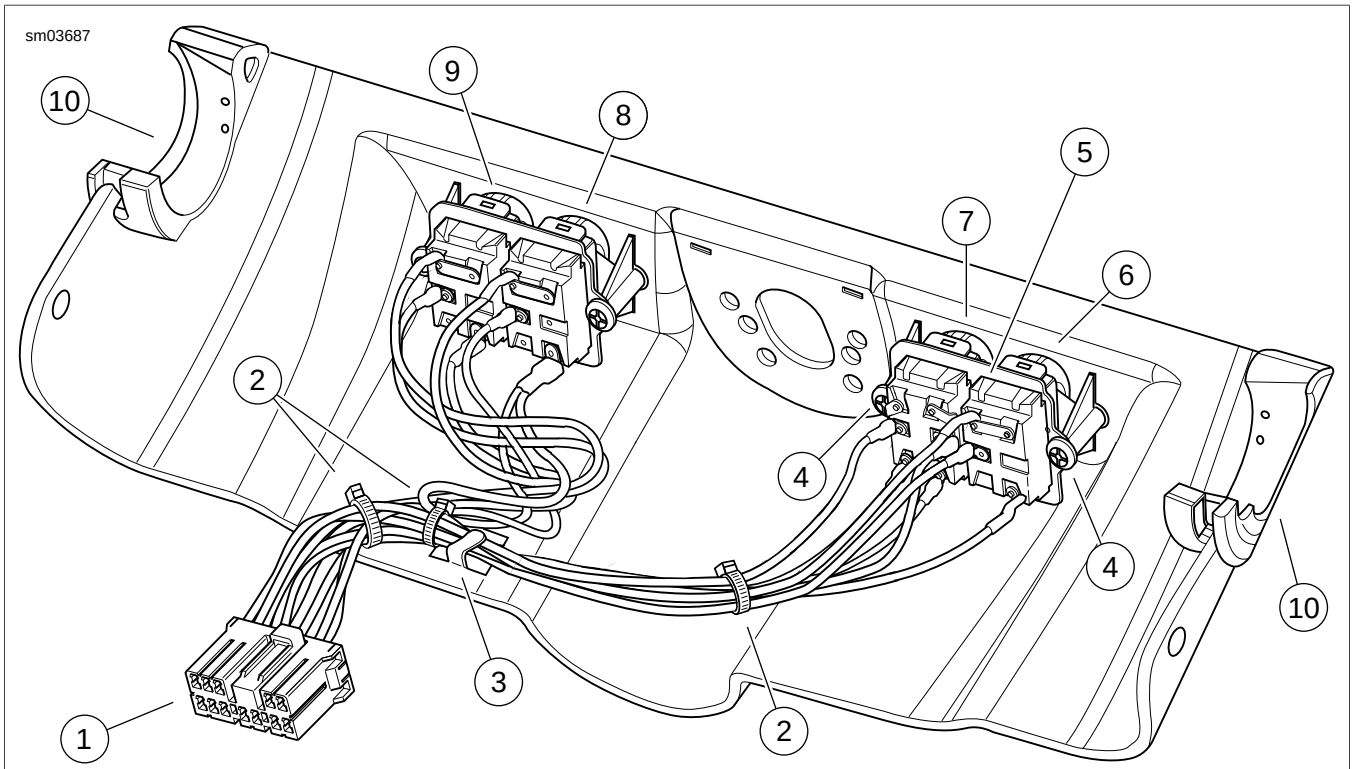
FAIRING CAP SWITCHES: FLHTC/U 7.19

REMOVAL

1. Partially disassemble ignition switch: remove ignition switch knob, spring, nut, collar, spacer and switch position plate. See 7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.
2. Remove two screws (with flat washers) to release fairing cap from left and right sides of inner fairing.
3. With the front forks turned to the left fork stop, reach behind right side of fairing cap and disconnect the fairing cap switch connector [105], 12-place Multilock.
4. See Figure 7-59. Remove fairing cap from motorcycle.
5. Bend back the flexible clamp to release switch wires from the inboard side of the fairing cap. Carefully cut cable straps to free wires from bundles.
6. Remove two screws to release switch bracket from fairing cap.
7. Gently pry two latches on bracket outward to release tabs on switch. Remove switch from bracket. See Figure 7-60.
8. If replacing Cruise or Speaker Switch, cut Black/Green wire lead halfway between Cruise and Speaker Switch terminals.
9. Follow the wires of the faulty switch to the socket housing, or reference Figure 7-61 and Table 7-13 for the applicable chamber numbers. For wire location purposes, numbers are stamped into the secondary locks of both the pin and socket housings.
10. Remove the appropriate terminals from the socket housing.

NOTE

For instructions on properly removing wire terminals, see A.1 AMP MULTILOCK CONNECTORS.



1. **Fairing cap switch connector [105]**
2. **Cable strap**
3. **Flexible clamp**
4. **Switch bracket screws**
5. **Switch bracket**
6. **Auxiliary lamp switch**
7. **Speaker switch**
8. **Cruise switch**
9. **Accessory switch**
10. **Grommet**

Figure 7-59. FLHTCU Fairing Cap (Inboard Side)

INSTALLATION

1. Feeding wires through bracket, place **new** switch into position. Engage tabs on switch in slots of latches and then gently bend tabs upward to lock position of switch in bracket.
2. Install terminals into socket housing.

NOTE

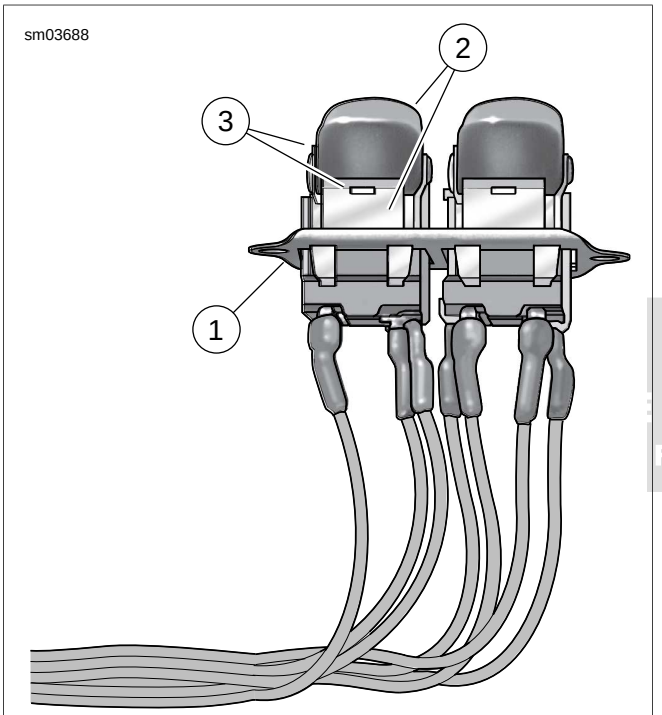
For instructions on properly installing wire terminals, see A.1 AMP MULTILOCK CONNECTORS.

3. If Cruise or Speaker Switch was replaced, butt splice Black/Green wire lead between Cruise and Speaker Switch terminals.

NOTE

For detailed butt splicing information, see A.17 SEALED SPLICE CONNECTORS.

4. Install two screws to secure switch bracket to fairing cap.
5. Install **new** cable straps to capture wire bundles and then secure switch wires to the fairing cap using the flexible clamp. Route the wires as shown in Figure 7-59.
6. Verify that the rubber grommets are installed on each side of the fairing cap. Barbs on cap fit into holes in grommets.



1. **Switch bracket**
2. **Latch**
3. **Tab**

Figure 7-60. Bend Latches Outward to Release Tabs

Table 7-13. Fairing Cap Switches [105]

SWITCH	WIRE COLOR	CHAMBER NUMBER
Accessory	Orange/Red	1
	Orange	2
	Black	3
Cruise Ultra Only	Orange/Violet	4
	Red/Green	5
	Black/Green (Double Lugged)	12 To Speaker Switch
Auxiliary Lamp	Yellow	6
	Gray/Black	7
	Black	8
Speaker Ultra Only	Orange/Blue	9
	Violet/Orange	10
	Brown/Orange	11
	Black/Green	To Cruise Switch

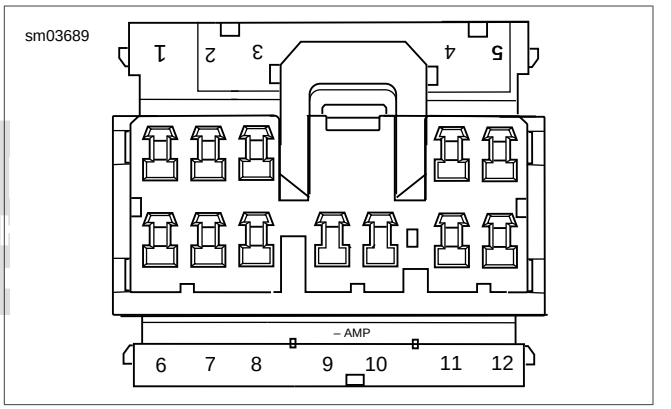


Figure 7-61. Socket Housing (Secondary Locks Open)

7. Connect the fairing cap switch connector [105], 12-place Multilock, on the right side of fairing cap.
8. With the front forks turned to the left fork stop, install fairing cap over ignition switch housing. Verify that grommets in fairing cap fully capture handlebar, handlebar switch conduit, and brake line from front master cylinder reservoir (right side).
9. Start two screws (with flat washers) to fasten fairing cap to left and right sides of inner fairing. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
10. Assemble ignition switch: install switch position plate, spacer, collar, nut, spring and knob. See 7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.

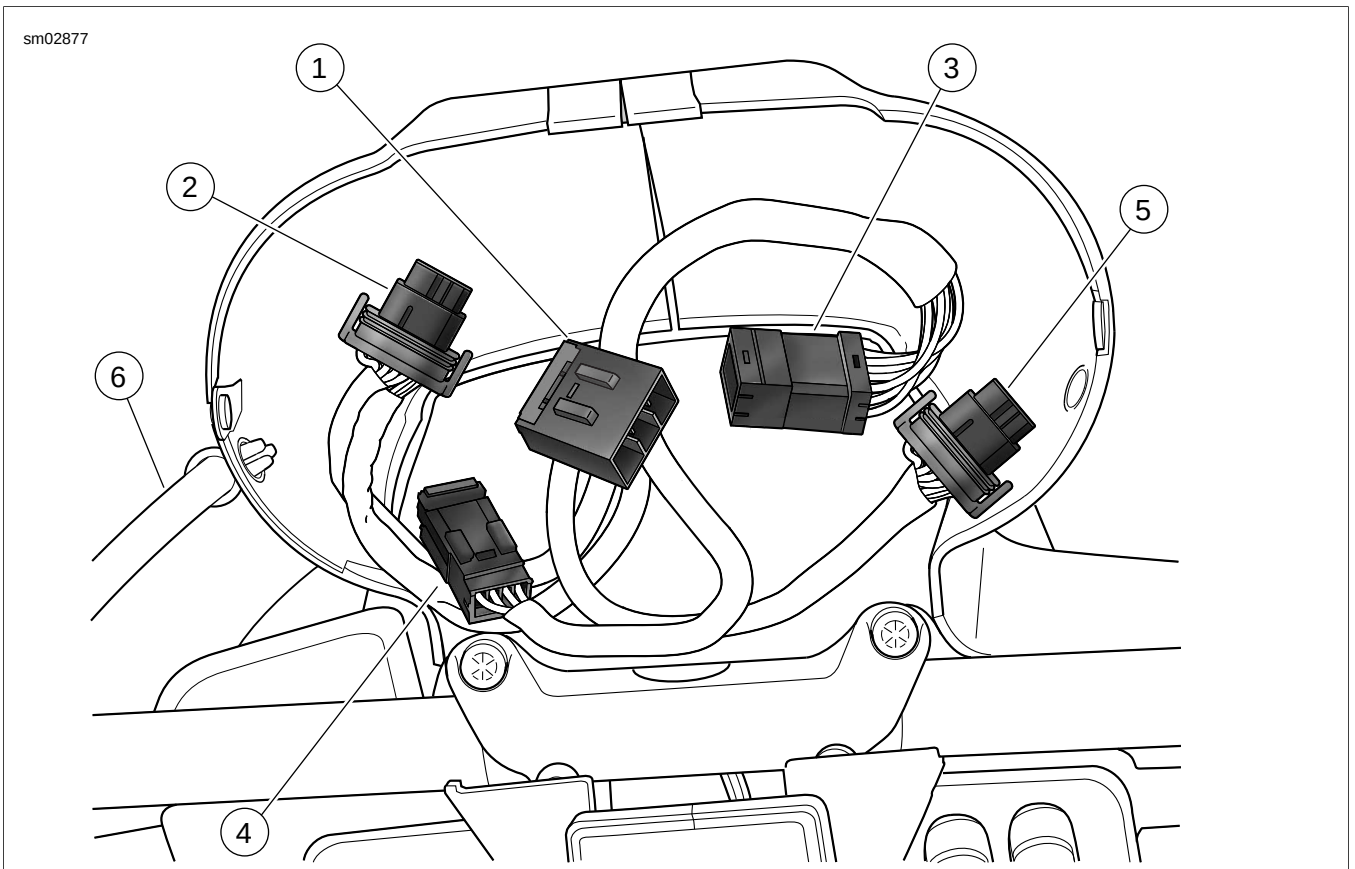
INSTRUMENT NACELLE SWITCHES: FLTR 7.20

REMOVAL

1. Partially disassemble ignition switch: remove ignition switch knob, spring, nut, collar, spacer and switch position plate. See 7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.
2. Remove screw on each side of bezel.
3. Use thumbs to push tab at rear of bezel from slot in front of ignition switch. Gently raise free side of bezel until tabs at front of instrument nacelle become disengaged from slot at front of bezel (concealed behind decorative adhesive strip).
4. See Figure 7-62. Raising bezel slightly, disconnect instruments and indicator lights from interconnect harness as follows:
 a. Speedometer connector [39], 12-place Packard.
 b. Tachometer connector [108], 12-place Packard.
 c. Indicator lights connector [21], 10-place Multilock.
5. Remove bezel from motorcycle.
6. Follow instructions based on location of defective switch.

Left Side Switch

1. See Figure 7-62. Disconnect speaker switch connector [105], 4-place Multilock.
2. Pull clutch cable clip from hole on left side of instrument nacelle.
3. Remove two screws (with flat washers) to release left side of instrument nacelle from upper and lower fork brackets.
4. See Figure 7-62. Unthread rubber boot from odometer reset switch, and while carefully removing left side instrument nacelle from motorcycle, pull odometer reset switch from hole. Move left side of nacelle to bench area leaving right side on motorcycle.
5. Gently bend back molded retainer to release switch bracket assembly from instrument nacelle.
6. See Figure 7-63. Carefully pry two latches on bracket outward to release tabs on switch. Remove switch from bracket.



1. **Indicator lights [21]**
2. **Speedometer gauge [39]**
3. **Instrument nacelle switches [105A/B]**
4. **Speaker switch [105C/D]**
5. **Tachometer gauge [108]**
6. **Clutch cable**

Figure 7-62. Instrument Nacelle (Bezel Removed)

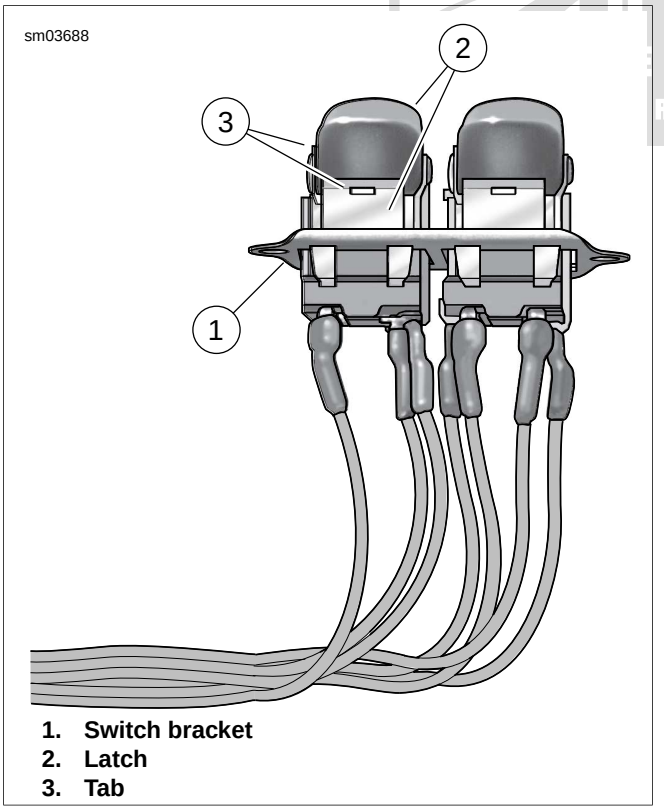
Right Side Switches

1. See Figure 7-62. Disconnect speaker switch connector [105], 4-place Multilock.
2. See Figure 7-62. Disconnect instrument nacelle switch connector [105], 12-place Multilock.
3. See Figure 7-62. Remove two screws (with flat washers) to release right side of instrument nacelle from upper and lower fork brackets. Move right side of nacelle to bench area leaving left side on motorcycle.
4. Gently bend back molded retainer to release switch bracket assembly from instrument nacelle.
5. See Figure 7-63. Carefully pry two latches on bracket outward to release tabs on switch. Remove switch from bracket.
6. See Figure 7-64. Remove the appropriate terminals from the socket and/or pin housings. Follow the wires of the faulty switch or reference Table 7-14 for the applicable chamber numbers. For wire location purposes, numbers are stamped into the secondary locks.

NOTE

For instructions on properly removing wire terminals, see A.1 AMP MULTILOCK CONNECTORS.

7. Carefully pull wires to draw terminals through conduit to backside of switch. For best results, pull one wire at a time.



1. **Switch bracket**
2. **Latch**
3. **Tab**

Figure 7-63. Bend Latches Outward to Release Tabs

Table 7-14. Right Side Instrument Nacelle Switches

SWITCH	WIRE COLOR	CHAMBER NUMBER	
		12-PLACE SOCKET	4-PLACE PIN
Accessory	Orange/Red	1	
	Orange	2	
	Black	3	
Cruise	Orange/Violet	4	
	Red/Green	5	
	Black/Green (Double Lugged)	12	4

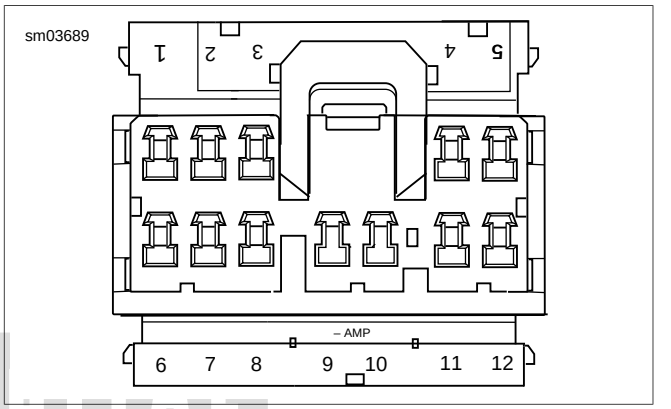


Figure 7-64. Socket Housing (Secondary Locks Open)

INSTALLATION

Left Side Switch

1. Place **new** switch into position in bracket. Engaging tabs on switch in slots of latches, gently bend tabs upward to lock position of switch in bracket.
2. Snap switch bracket into molded retainer in instrument nacelle.
3. See Figure 7-65. While carefully placing left side of instrument nacelle on motorcycle, slide odometer reset switch through hole and install rubber boot.
4. See Figure 7-62. Connect speaker switch connector [105], 4-place Multilock.
5. Install two screws (with flat washers) to fasten left side instrument nacelle to upper and lower fork brackets. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm).
6. Capture clutch cable in cable clip. Insert cable clip into hole in left side of instrument nacelle.

Right Side Switches

1. See Figure 7-63. Place **new** switch into position in bracket. Engaging tabs on switch in slots of latches, gently bend tabs upward to lock position of switch in bracket.



1. **Left side nacelle**
2. **Clutch cable clip hole**
3. **Speaker switch connector [105D]**
4. **Right side nacelle**
5. **Speaker switch connector [105C]**
6. **Instrument nacelle switch connector [105B]**

Figure 7-65. Instrument Nacelle Halves

2. Push terminals through two lengths of conduit to wire end of socket or pin housing. For best results, push one wire through conduit at a time.
3. See Figure 7-64 and refer to Table 7-14. Install terminals into socket or pin housing.

NOTE

For instructions on properly installing wire terminals, see A.1 AMP MULTILOCK CONNECTORS.

4. Snap switch bracket into molded retainer in instrument nacelle.
5. See Figure 7-65. Install right side of instrument nacelle on motorcycle.
6. See Figure 7-62. Connect speaker switch connector [105], 4-place Multilock.
7. Connect instrument nacelle switch connector [105], 12-place Multilock.
8. Install two screws (with flat washers) to fasten right side instrument nacelle to upper and lower fork brackets. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm).

9. Looking into instrument nacelle, connect instruments and indicator lights to interconnect harness as follows:
 a. Speedometer connector [39], 12-place Packard.
 b. Tachometer connector [108], 12-place Packard.
 c. Indicator lights connector [21], 10-place Multilock.
10. Verify that left and right sides of instrument nacelle are properly mated. Pins on left side of nacelle must fully engage holes on right.
11. Insert tab at rear of bezel into slot of instrument nacelle (just in front of ignition switch). Holding left and right sides of nacelle together, place bezel over instrument nacelle flange. When properly mated, tabs at front of instrument nacelle engage lip in slot at front of bezel (behind decorative adhesive strip).

NOTE

*If tabs do not properly engage slot at front of bezel, then a loose fit will result. Remove decorative adhesive strip by gently prying up outer edges, and using a flat bladed screwdriver, carefully raise tabs so that they engage lip in slot. If damaged, install **new** decorative adhesive strip.*

12. Install screw on each side of bezel. Alternately tighten screws to 25-35 **in-lbs** (2.8-4.0 Nm).
13. Assemble ignition switch. See 7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

CRANKSHAFT POSITION SENSOR (CKP) 7.21

GENERAL

The crank position sensor is a variable reluctance (VR) sensor that generates an AC signal by sensing the passing of the 30 teeth machined in the left side flywheel. Two consecutive teeth are missing in the flywheel to establish a reference point. The crank position sensor sends a signal to the electronic control module which is used to reference engine position (TDC) and engine speed.

NOTE

CKP sensor connector is not serviceable. If connector or sensor fails, the entire assembly must be replaced.

REMOVAL

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Locate CKP sensor connector [79], 2-place Deutsch, fixed to front caddy at bottom of lower frame crossmember.
3. Push connector toward right side of motorcycle to disengage small end of slot on attachment clip from T-stud on front caddy. Lift connector off T-stud.
4. Press button on socket terminal side and pull apart pin and socket halves.
5. See Figure 7-66 and Figure 7-67. Remove screw to free CKP sensor mount from front left side of crankcase. Pull sensor from bore.

INSTALLATION

1. Install **new** O-ring on sensor body if missing, distorted, pinched or otherwise damaged. Apply a thin film of clean H-D 20W50 engine oil to O-ring before installation.
2. See Figure 7-66. Push sensor into bore aligning hole in sensor mount with hole in spot face. Install screw and tighten to 90-120 **in-lbs** (10.2-13.6 Nm).
3. Route connector and convoluted tubing downward at rear of front engine stabilizer link to front caddy at bottom of lower frame crossmember.
4. Mate pin and socket halves of CKP sensor connector [79].

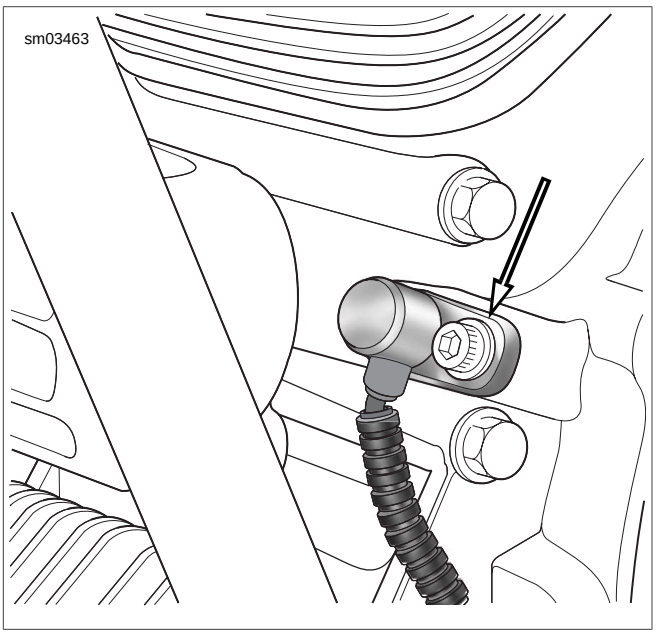


Figure 7-66. Remove CKP Sensor Mount Screw

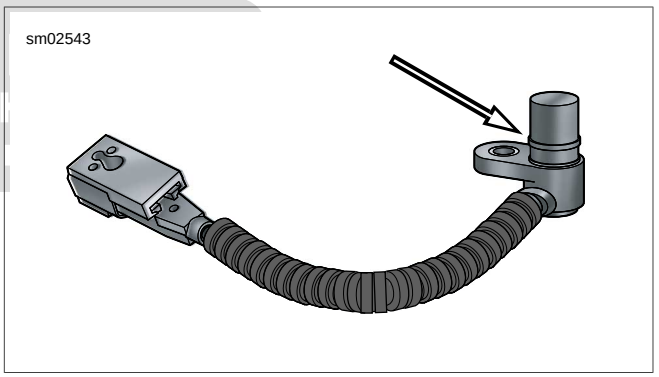


Figure 7-67. CKP Sensor O-Ring

5. Place large end of slot on attachment clip over T-stud on front caddy. Push connector toward left side of motorcycle to engage small end of slot.
6. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

ALTERNATOR 7.22

REMOVAL

1. Remove seat. See 2.28 SEAT.

⚠WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Remove battery negative (-) cable (black) from battery.
3. Remove the primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.

⚠CAUTION

The high-output rotor contains powerful magnets. Exercise caution to prevent possible hand injury during removal and installation. (00558b)

4. See Figure 7-68. Grasp the rotor/spring cover assembly with both hands and pull from the engine compensating sprocket shaft.
5. See Figure 7-69. Release locking latch and remove connector (1).
6. Cut anchored cable strap securing stator wiring to frame.

NOTE

The rubber molded stator connector is not serviceable. Damage to terminals or molding requires stator and/or voltage regulator replacement.

7. Remove four screws to free stator from crankcase. Discard screws.
8. See Figure 7-70. Using point of awl or small screwdriver, carefully move grommet away from crankcase and squirt isopropyl alcohol or glass cleaner into opening. Repeat this step at one or two other locations around grommet.
9. While pushing on the grommet from outside of crankcase, draw grommet through the bore by pulling on inside of grommet with needle nose pliers. Do not pull on the wires unless the stator is to be replaced. Exercise caution to avoid damaging ribs on grommet if stator is to be reused.
10. Draw conduit and connector through crankcase bore as stator is removed.

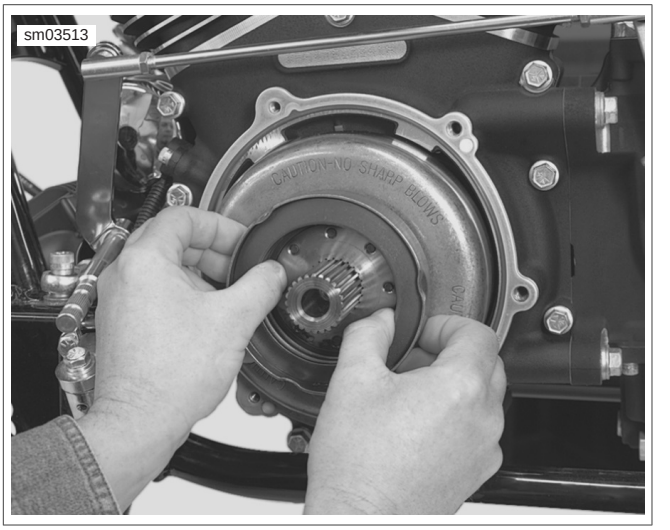
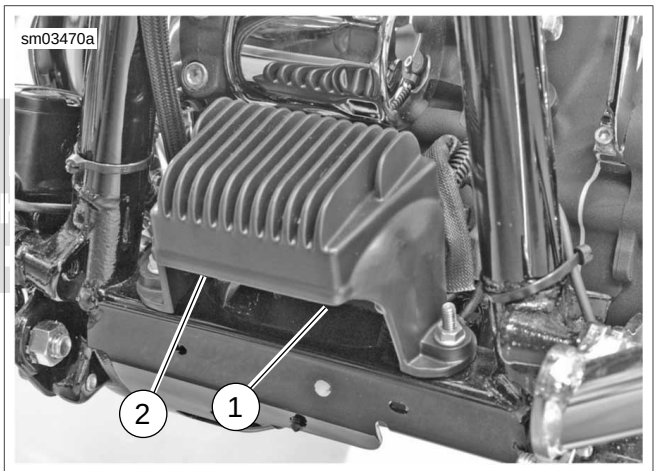


Figure 7-68. Remove Rotor/Spring Cover Assembly

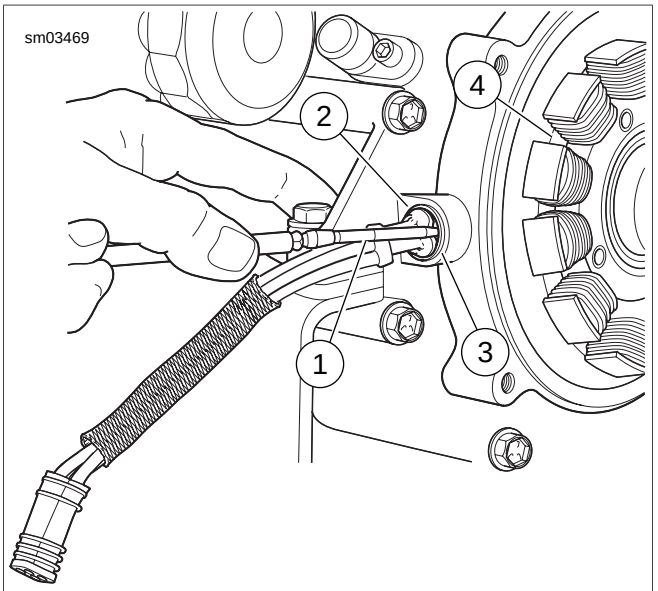


1. **Stator connector [46]**
2. **Voltage regulator output connector [77]**

Figure 7-69. Voltage Regulator (Left Side View)

CLEANING AND INSPECTION

1. Check inside of rotor and remove any metal fragments captured by magnets.
2. Clean the rotor using a petroleum solvent. Clean the stator and grommet by wiping it with a clean cloth.



1. **Awl**
2. **Capped rib**
3. **Opening**
4. **Stator**

Figure 7-70. Remove Grommet From Crankcase

INSTALLATION

1. Feed connector and conduit through hole in crankcase from inside crankcase.
2. Thoroughly lubricate grommet with isopropyl alcohol or glass cleaner. Ribs of grommet must be clean and free of dirt and oily residue.
3. Carefully grasp cable stop behind grommet with a needle nose pliers. Push grommet into crankcase bore while carefully pulling on outside cable. Installation is complete when cable stop contacts casting and capped rib of grommet exits crankcase bore.
4. If necessary, carefully run awl around edge of capped rib so that it rests flat against seating surface on crankcase.

NOTE

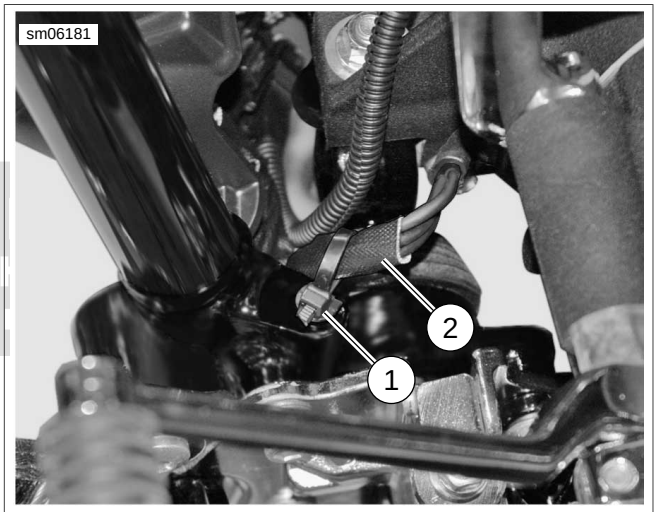
Do not reuse stator mounting screws. The threads of the screws contain a locking compound in pellet form. When the screw is started, the pellet breaks, releasing the compound.

5. Secure stator to crankcase using four **new** screws. Tighten screws to 55-75 **in-lbs** (6.2-8.5 Nm).
6. See Figure 7-71. Install **new** anchored cable strap (1) on stator wiring (2) and push anchor into hole in frame.
7. Install connector to voltage regulator and engage locking latch.

⚠CAUTION

The high-output rotor contains powerful magnets. Exercise caution to prevent possible hand injury during removal and installation. (00558b)

8. Grasp the rotor/spring cover assembly with both hands and ease onto the engine compensating sprocket shaft.
9. Install the primary chaincase. See 5.5 PRIMARY CHAIN-CASE HOUSING.
10. Connect battery negative cable (black) to battery negative (-) terminal. Tighten bolt to 60-70 **in-lbs** (6.8-7.9 Nm).
11. Install seat. See 2.28 SEAT.



1. **Anchored cable strap**
2. **Stator wiring**

Figure 7-71. Stator Wiring

VEHICLE SPEED SENSOR (VSS) 7.23

VSS

Removal

1. Remove starter. See 7.9 STARTER.
2. See Figure 7-72. Disconnect VSS connector [65], 3-place Delphi.
3. Remove screw and pull sensor from transmission case.

Installation

1. Inspect VSS O-ring for cuts, tears or general deterioration. Replace as necessary.
2. Insert sensor into transmission case. Install screw and tighten to 84-132 **in-lbs** (9.5-14.9 Nm).
3. Connect VSS connector [65], 3-place Delphi.
4. Install starter. See 7.9 STARTER.



Figure 7-72. VSS Location

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NEUTRAL SWITCH 7.24

REMOVAL

1. Verify that transmission is in NEUTRAL.
2. See Figure 7-73. Remove two elbow connectors from neutral switch posts.
3. Remove neutral switch from transmission case.

INSTALLATION

1. See Figure 7-74. Inspect O-ring for cuts, tears or general deterioration. Replace as necessary. Lightly lubricate **new** O-ring with clean transmission oil before installation.
2. Verify that transmission is in NEUTRAL.
3. Install neutral switch in transmission case and tighten to 120-180 **in-lbs** (13.6-20.3 Nm).

NOTE

The neutral switch is not polarity sensitive The elbow connectors can be installed on either post.

4. Install two elbow connectors onto neutral switch posts.
5. Test neutral switch for proper operation as follows:
 a. Verify that transmission is in NEUTRAL.
 b. Turn Ignition/Light Key Switch to IGNITION.
 c. Verify that neutral indicator light illuminates.

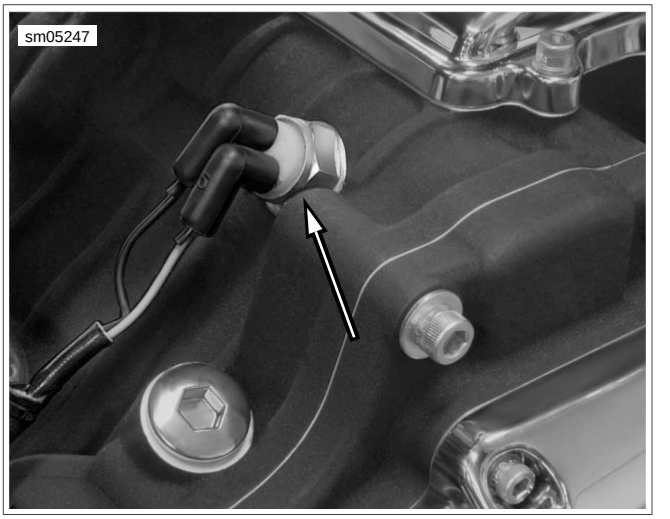


Figure 7-73. Neutral Switch

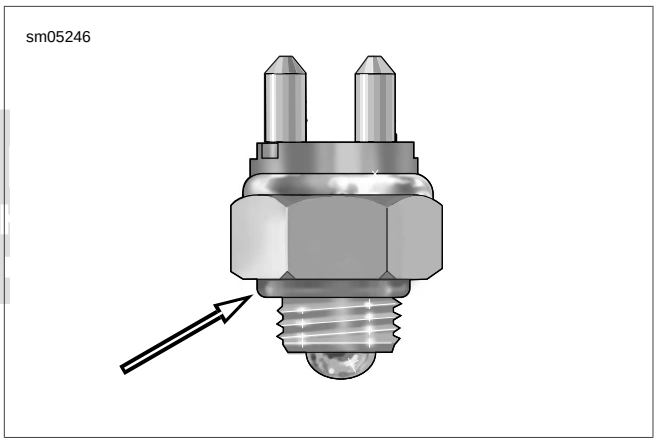


Figure 7-74. Neutral Switch O-Ring

OIL PRESSURE SWITCH AND SENDER 7.25

REMOVAL

1. **FLHR/C:** See Figure 7-75. Remove elbow connector (1) from post terminal of oil pressure switch (2).
2. **FLHX, FLHT/C/U, FLTR:** Remove 4-place Delphi connector (3) from oil pressure sender (4).
3. Remove switch or sender from crankcase.

INSTALLATION

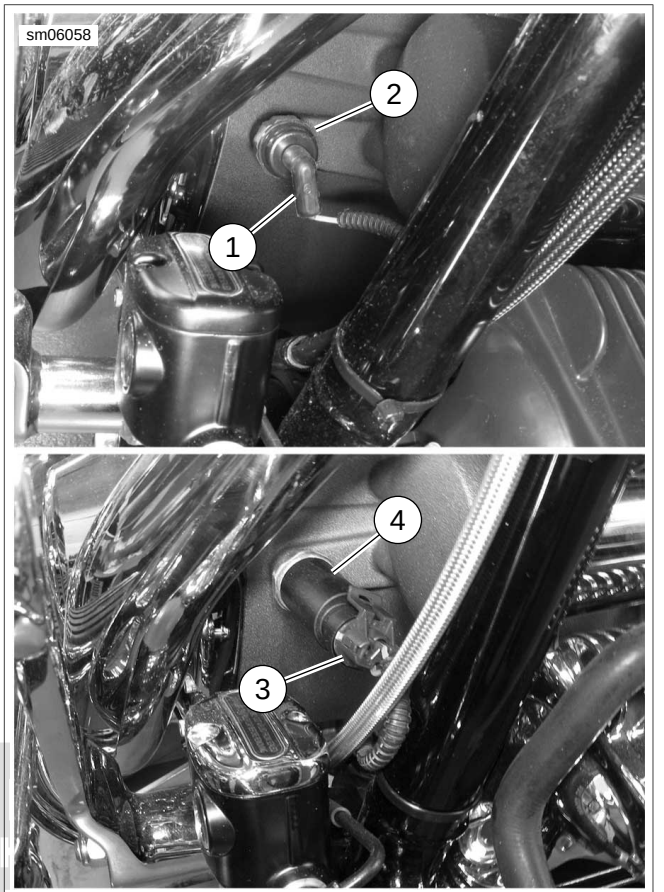
NOTE

If reusing oil pressure switch/sender, apply Loctite Pipe Sealant with Teflon 565 to threads.

1. See Figure 7-75. Start oil pressure switch or sender into crankcase bore.
2. **FLHR/C:**
 a. Tighten oil pressure switch to 96-120 **in-lbs** (11-14 Nm).
 b. Install elbow connector (1) onto post terminal.
3. **FLHX, FLHT/C/U, FLTR:**
 a. Tighten oil pressure sender to 96-120 **in-lbs** (11-14 Nm).
 b. Install 4-place Delphi connector (3).

 NOTE

 Be sure harness is routed outside frame rail as shown.
4. Test oil pressure switch/sender for proper operation and check for leaks.



1. Elbow connector
2. Oil pressure switch
3. Delphi connector
4. Oil pressure sender

Figure 7-75. Oil Pressure Switch/Sender

STOPLIGHT SWITCHES 7.26

FRONT STOPLIGHT SWITCH

Removal/Installation

See 7.40 HANDLEBAR SWITCH ASSEMBLIES.

REAR STOPLIGHT SWITCH

Removal

CAUTION

D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)

NOTE

Immediately wipe up any brake fluid spillage with a clean, dry, soft cloth. Follow up by thoroughly wiping affected area with a clean, damp, soft cloth (small spills) or washing with a large quantity of soapy water (large spills).

1. See Figure 7-76. Remove wire connectors (1).

NOTE

Wrap rear brake line with piece of shop towel to absorb any loss of brake fluid.

2. Hold brake line fitting (3) and remove rear stoplight switch (2).

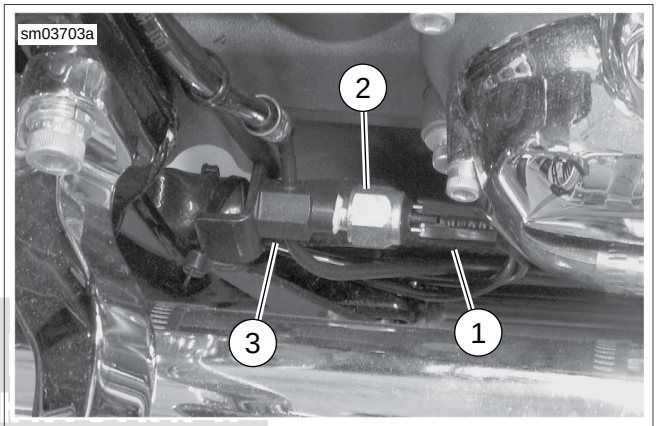
Installation

1. Apply Loctite Pipe Sealant with Teflon 565 to threads of rear stoplight switch.
2. See Figure 7-76. Install rear stoplight switch (2) into rear brake line fitting (3).
3. Hold brake line fitting and tighten rear stoplight switch to 12-15 ft-lbs (16.3-20.3 Nm).
4. Fill and bleed rear brake system. See 1.16 BLEEDING BRAKES.

WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

5. Verify proper operation of tail lamp/rear brake light.



1. **Wire connectors**
2. **Stoplight switch**
3. **Brake line fitting**

Figure 7-76. Rear Stoplight Switch

HORN 7.27

INSPECTION

If the horn fails to sound or does not sound satisfactorily, check for loose, frayed or damaged wires leading to horn terminal, discharged battery or corroded ground.

The horn is permanently sealed and non-repairable. Only the mounting hardware is replaceable.

NOTE

No tonal adjustments may be made to this horn.

REMOVAL

1. Remove acorn nut and flat washer to free horn assembly from rubber mount stud.
2. Remove elbow terminals from spade contacts and release main harness conduit from J-clamp.
3. Remove flange nut (10mm) from circular recess at back of horn bracket. Remove horn from chrome horn cover.

INSTALLATION

1. Fit horn into chrome cover so that stud at back slides through hole in horn bracket. Apply two drops of Loctite Low Strength Threadlocker 222 (purple) to threads of horn stud.

NOTE

Overtightening the flange nut can cause permanent horn damage resulting in reduced volume and tone quality.

2. Install flange nut (10mm) on horn stud and tighten to 80-100 **in-lbs** (9.0-11.3 Nm).
3. Install elbow terminals onto spade contacts.

NOTE

The horn is not polarity sensitive. Elbow terminals may be attached to either spade contact.

4. Capture main harness conduit in J-clamp and install horn bracket onto rubber mount stud. Install flat washer and acorn nut. Tighten acorn nut to 80-120 **in-lbs** (9.0-13.6 Nm).

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

CIGARETTE LIGHTER: FLHX, FLHT/C/U, FLTR 7.28

TROUBLESHOOTING

NOTE

The lighter socket is not intended to be used as a power port for electrical devices. Damage to the lighter socket may occur.

1. Ignition/light key switch must be ON or in ACCESSORY position for lighter operation.
2. If lighter does not work, substitute a known good lighter element.
3. If lighter is still inoperative, check for 12 vdc at center socket contact and ground at outer shell contact.
4. Refer to applicable wiring diagram in B.2 WIRING DIAGRAMS if 12 vdc or ground are not present. Use voltage checks to isolate problem.

REMOVAL

1. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
2. Disconnect socket terminals from spade contacts on cigarette lighter.
3. Remove lighter from socket. Holding socket, unscrew outer shell. Remove socket and outer shell from inner fairing.

INSTALLATION

1. Slide socket of cigarette lighter through bore in fairing. Thread outer shell onto socket until tight. Install cigarette lighter in socket.
2. Connect orange wire terminal to center socket spade contact, the black wire terminal to outer shell contact.
3. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR 7.29

2 INCH DIAMETER GAUGES: FUEL LEVEL, AMBIENT AIR TEMPERATURE, VOLTMETER, OIL PRESSURE

Removal

1. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
2. Pull 2-place and 3-place socket housings to release interconnect harness from lamp and gauge, respectively.

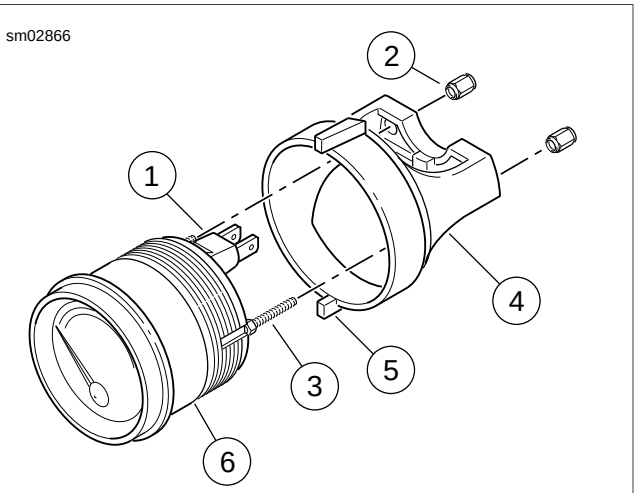
NOTE

*See Figure 7-77. To replace lamp, pull pin housing from gauge and then pull lamp from slot of pin housing. Install **new** lamp in slot and insert pin housing back into gauge.*

3. Remove hex nuts from studs. Remove mounting bracket.
4. Remove gauge from inner fairing.

Installation

1. Install gauge in inner fairing.
2. See Figure 7-77. Slide mounting bracket over studs. Verify that tabs on top and bottom of bracket engage slots in inner fairing.
3. Loosely install hex nuts on studs. Verify that gauge is properly aligned and then tighten nuts to 10-20 **in-lbs** (1.1-2.3 Nm).
4. Install 3-place and 2-place socket housings to connect interconnect harness to gauge and lamp, respectively.
5. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.



1. **Pin housing**
2. **Hex nut**
3. **Stud**
4. **Mounting bracket**
5. **Tab**
6. **Gauge**

Figure 7-77. 2 Inch Diameter Gauges

TACHOMETER

Removal

1. Proceed as follows:
 a. **FLHX, FLHT/C/U:** Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
 b. **FLTR:** Remove bezel. See 2.42 INSTRUMENT BEZEL: FLTR.
2. Remove tachometer connector [108], 12-place Packard, at back of tachometer.
3. Remove two screws to free tachometer bracket from back of tachometer gauge.
4. Push tachometer gauge toward rear of motorcycle to remove from inner fairing (FLHX, FLHT/C/U) or bezel bore (FLTR).

Installation

1. Insert tachometer gauge into inner fairing (FLHX, FLHT/C/U) or bezel bore (FLTR).
2. Align holes in tachometer bracket with those at back of tachometer gauge and start two screws.
3. Rotate tachometer gauge until tabs at top and bottom of bracket engage slots in inner fairing (FLHX, FLHT/C/U) or bezel (FLTR).

4. Verify that gauge is properly aligned and tighten two screws to 10-20 **in-lbs** (1.1-2.3 Nm).
5. Install tachometer connector [108], 12-place Packard, at back of tachometer.
6. Proceed as follows:
 a. **FLHX, FLHT/C/U:** Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
 b. **FLTR:** Install bezel. See 2.42 INSTRUMENT BEZEL: FLTR.

SPEEDOMETER

Removal

1. Proceed as follows:
 a. **FLHX, FLHT/C/U:** Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
 b. **FLTR:** Remove bezel. See 2.42 INSTRUMENT BEZEL: FLTR.
2. Remove speedometer connector [39], 12-place Packard, at back of speedometer.
3. Remove two screws to free speedometer bracket from back of speedometer gauge. On FLHX, FLHT/C/U models, leave anchor on interconnect harness installed in lower ear of speedometer bracket, if present.
4. Push speedometer gauge toward rear of motorcycle to remove from inner fairing (FLHX, FLHT/C/U) or bezel bore (FLTR).

Installation

1. Insert speedometer gauge into inner fairing (FLHX, FLHT/C/U) or bezel bore (FLTR).
2. Align holes in speedometer bracket with those at back of speedometer gauge and start two screws.

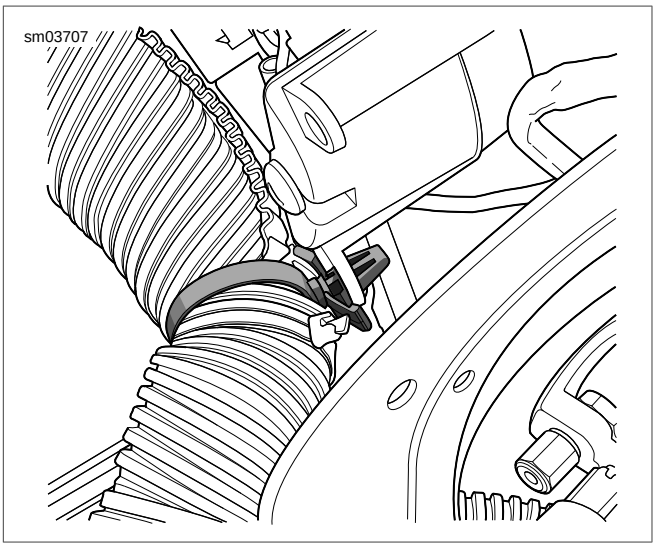


Figure 7-78. Anchor Interconnect Harness in Ear of Speedometer Bracket

3. Rotate speedometer gauge until tabs at top and bottom of bracket engage slots in inner fairing (FLHX, FLHT/C/U) or bezel (FLTR).
4. Verify that gauge is properly aligned and tighten two screws to 10-20 **in-lbs** (1.1-2.3 Nm).
5. Install speedometer connector [39], 12-place Packard, at back of speedometer.
6. Proceed as follows:
 a. **FLHX, FLHT/C/U:** Verify that anchor on interconnect harness is installed in lower ear of speedometer bracket. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
 b. **FLTR:** Install bezel. See 2.42 INSTRUMENT BEZEL: FLTR.

DIGITAL TECHNICIAN HARLEY-DAVIDSON

INDICATOR LAMPS: FLHX, FLHT/C/U, FLTR 7.30

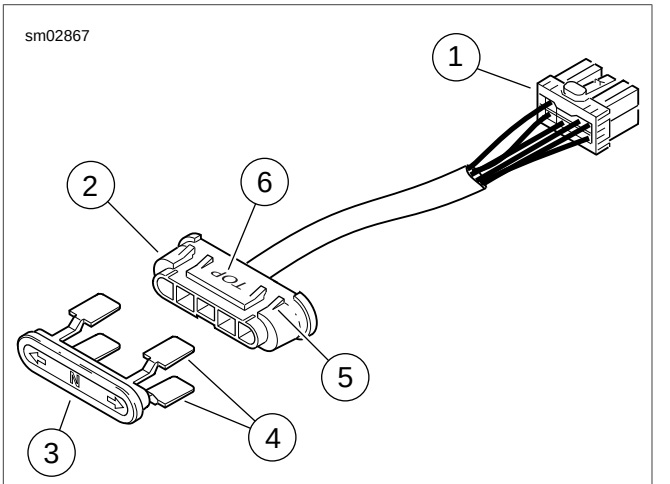
INDICATOR LAMPS

Removal

NOTE

All models are equipped with Light Emitting Diodes (LEDs) in lieu of indicator lamps. The indicator lamp assembly is not serviceable. If one LED is bad, the indicator lamp assembly must be replaced.

1. Proceed as follows:
 a. **FLHX, FLHT/C/U:** Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
 b. **FLTR:** Remove bezel. See 2.42 INSTRUMENT BEZEL: FLTR.
2. Disconnect indicator lamp connector [21], 10-place Multilock (black).
3. On FLHX, FLHT/C/U models, remove tachometer gauge to access indicator lamp assembly. See 7.29 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR.
4. See Figure 7-79. Release each paddle on lens from pair of index tabs on indicator lamp assembly. Remove lens from inner fairing (FLHX, FLHT/C/U) or bezel (FLTR), if damaged.



1. **Indicator lamp connector [21]**
2. **Indicator lamp assembly**
3. **Lens**
4. **Paddles**
5. **Index tabs**
6. **Orientation stamp**

Figure 7-79. Indicator Lamp Assembly

Installation

1. Place lens in inner fairing (FLHX, FLHT/C/U) or bezel (FLTR), if removed. Note position of oil icon on FLTR models to be sure that lens is right side up. On FLHX, FLHT/C/U models, slot at bottom of lens engages index tab in inner fairing to prevent improper orientation.
2. With the word "TOP" facing upward, engage each paddle on lens with pair of index tabs on indicator lamp assembly.
3. Connect indicator lamp connector [21], 10-place Multilock (black).
4. On FLHX, FLHT/C/U models, install tachometer gauge. See 7.29 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR.
5. Proceed as follows:
 a. **FLHX, FLHT/C/U:** Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
 b. **FLTR:** Install bezel. See 2.42 INSTRUMENT BEZEL: FLTR.

DIGITAL TECHNICIAN HARLEY-DAVIDSON

FUEL GAUGE

Removal

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Draw fuel gauge connector [117], 4-place Multilock, out of tunnel on left side of fuel tank and disconnect.

NOTE

For instructions to remove wire terminals see A.1 AMP MULTI-LOCK CONNECTORS.

3. Remove terminals from connector housing.
4. Remove convoluted tubing from wires.
5. Remove the gauge from the top left side of the fuel tank. Do not twist during removal. Pull upward just far enough to free the gauge from the fuel tank.
6. Remove fuel gauge from motorcycle while feeding wires and pin terminals up through tube.
7. If reusing gauge, inspect rubber seal for tears, cuts or general deterioration. Replace seal if necessary. Install **new** seal so that flat side contacts edge of gauge.

Installation

1. Place **new** fuel gauge assembly next to discarded unit and cut wires to proper length.

NOTE

For instructions on crimping wire terminals, see A.1 AMP MULTILOCK CONNECTORS.

2. Crimp **new** pin terminals onto fuel gauge wires.
3. Feed wires down into tube while lowering cap into position. When pin terminals exit hole at bottom of fuel tank, gently pull wires while installing the fuel gauge on the fuel tank. Do not twist the gauge during installation. Hold the gauge firmly and press downward until it snaps in place.
4. Install convoluted tubing on wires.

NOTE

For instructions on properly installing wire terminals, see A.1 AMP MULTILOCK CONNECTORS.

5. See Figure 7-80. Install terminals into connector housing.
6. Route pin housing and convoluted tubing forward and then inboard between front of crossover hose fitting and bottom of fuel tank. Connect fuel gauge connector and feed into tunnel of fuel tank.
7. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

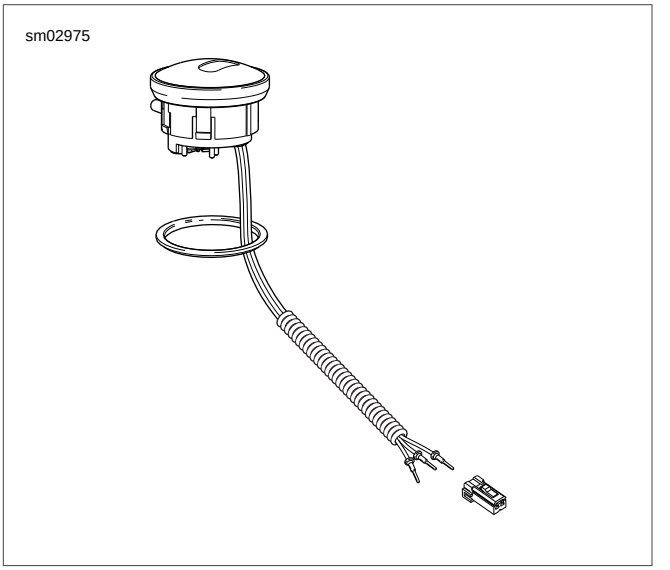


Figure 7-80. Fuel Gauge (FLHR/C)

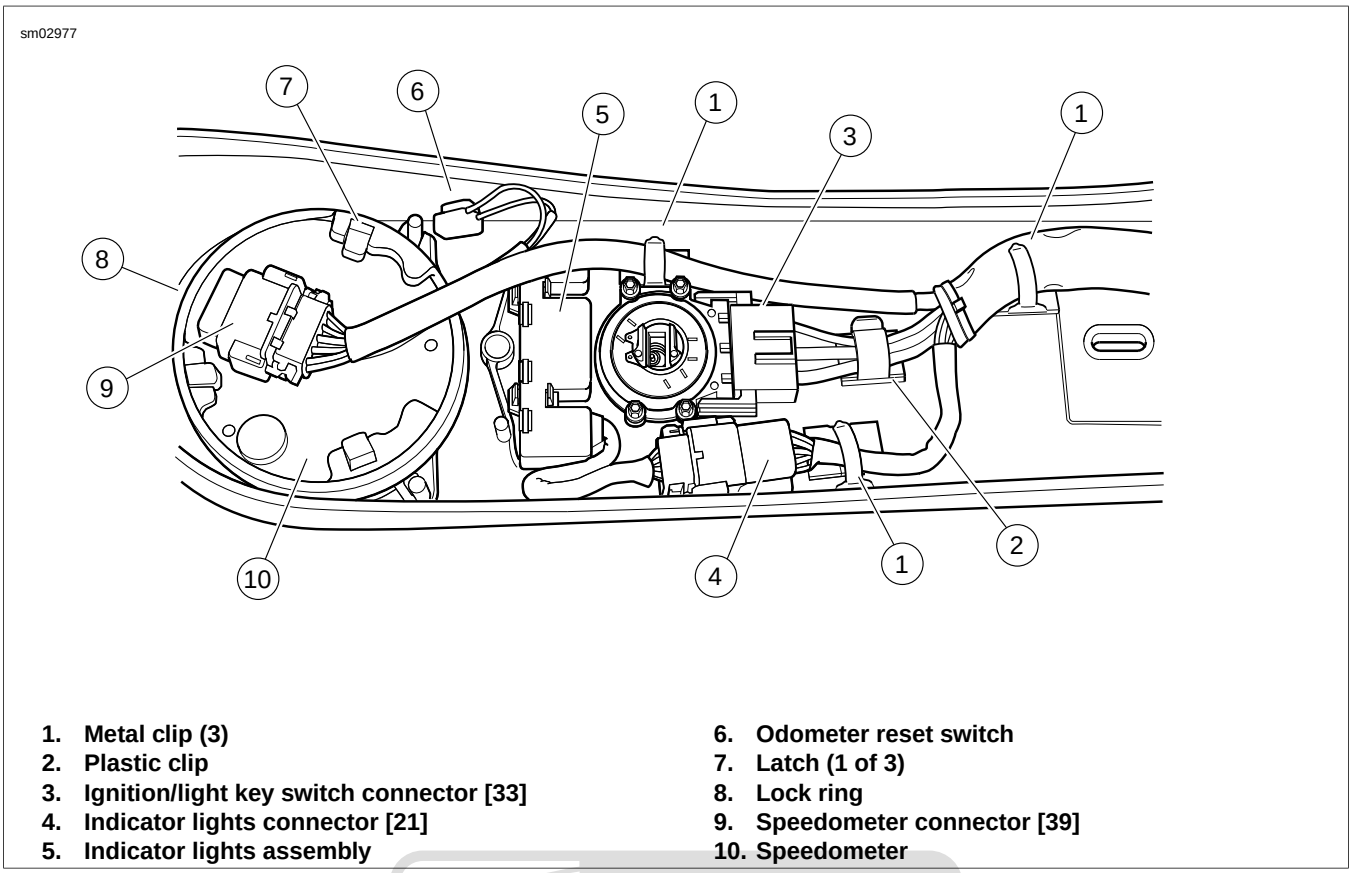
Table 7-15. FLHR/C Fuel Gauge [17]

WIRE COLOR	CHAMBER NUMBER
Orange	1
Yellow/White	2
-	3
Black	4

SPEEDOMETER

Removal

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Remove seat. See 2.28 SEAT.
3. Remove fasteners to release console from fuel tank.
4. Lay a clean shop towel on forward part of rear fender and lay console upside down on shop towel.
5. See Figure 7-81. Remove speedometer connector (9). If necessary, bend back flexible metal clips (1) to free connector conduit.
6. Gently pry three latches (7) upward to release lock ring (8) from back of speedometer.
7. Remove speedometer from top side of console.
8. Remove rubber gasket from speedometer bore.



1. **Metal clip (3)**
2. **Plastic clip**
3. **Ignition/light key switch connector [33]**
4. **Indicator lights connector [21]**
5. **Indicator lights assembly**
6. **Odometer reset switch**
7. **Latch (1 of 3)**
8. **Lock ring**
9. **Speedometer connector [39]**
10. **Speedometer**

Figure 7-81. Instrument Console Assembly (FLHR/C)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Installation

1. Lubricate groove in rubber gasket with isopropyl alcohol or glass cleaner. Place the gasket into position around the console speedometer bore.
2. Install speedometer into rubber gasket. Lubricate gasket with isopropyl alcohol or glass cleaner, if necessary. The speedometer should fit snugly against the gasket without movement.
3. See Figure 7-81. Place lock ring over back of speedometer aligning two slots with console bosses. Press latches (7) down until they lock into position.
4. Connect speedometer connector (9).
5. If released, bend flexible metal clips (1) to capture connector conduit.
6. Exercising caution to avoid pinching wire harness and vent tube, position console on fuel tank.
7. Install front and rear fasteners to secure console to fuel tank.
8. Tighten fasteners to 36-60 **in-lbs** (4.1-6.8 Nm).
9. Install seat. See 2.28 SEAT.
10. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

INDICATOR LAMPS: FLHR/C 7.32

INDICATOR LAMPS

Removal

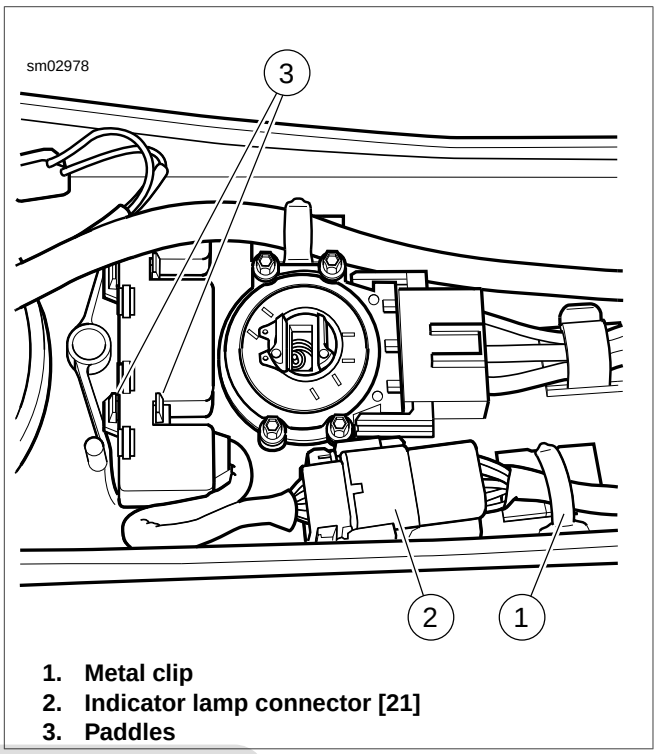
NOTE

All models are equipped with Light Emitting Diodes (LEDs) in lieu of indicator lamps. The indicator lamp assembly is not serviceable. If one LED is bad, the indicator lamp assembly must be replaced.

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Remove seat. See 2.28 SEAT.
3. Remove fasteners to release console from fuel tank.
4. Lay a clean shop towel on forward part of rear fender and lay console upside down on shop towel.
5. See Figure 7-82. Disconnect indicator lamp connector (2). If necessary, bend flexible metal clip (1) to free connector conduit.
6. Remove indicator lamp assembly from console as follows:
 a. Insert the blade of a large screwdriver under rear corner of indicator lamp assembly.
 b. Squeeze front and rear paddles (3) on same side of assembly while rotating screwdriver.
 c. When one side of assembly becomes free, repeat procedure on opposite side to release unit from console.

Installation

1. Install indicator lamp assembly into console as follows:
 a. Place assembly into position in console engaging four paddles in slots of indicator lamp assembly.
 b. While pushing down on assembly, push up on lens on outboard side of console until assembly fits snugly.



1. **Metal clip**
2. **Indicator lamp connector [21]**
3. **Paddles**

Figure 7-82. Release Paddles to Free Indicator Lamp Assembly (FLHR/C)

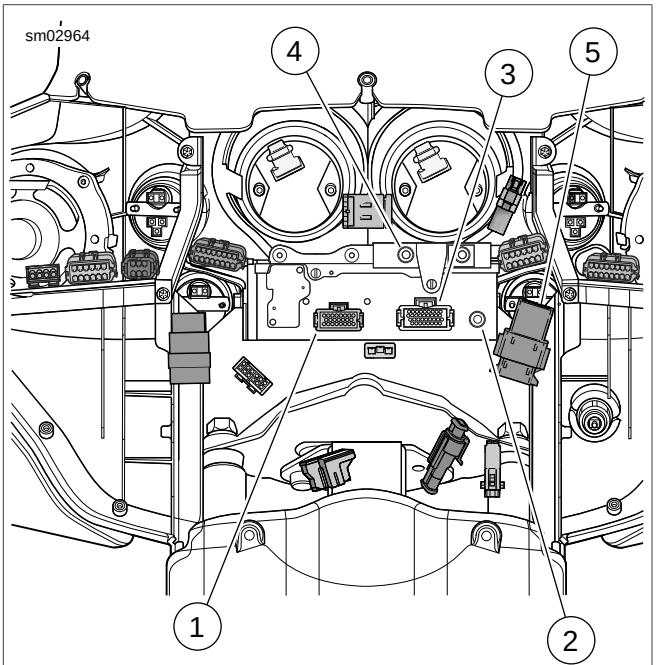
2. Connect indicator lamp connector. If released, bend flexible metal clip to capture connector conduit.
3. Exercising caution to avoid pinching wire harness and vent tube, position console on fuel tank.
4. Install front and rear fasteners to secure console to fuel tank.
5. Tighten fasteners to 36-60 **in-lbs** (4.1-6.8 Nm).
6. Install seat. See 2.28 SEAT.
7. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

RADIO (STORAGE BOX)

Removal

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
3. **FLHX, FLHTC, FLTR:**
 a. See Figure 7-83. Disconnect radio connector (1).
 b. Disconnect radio antenna cable connector (2).
4. **FLHTCU:**
 a. See Figure 7-83. Disconnect radio connector (1).
 b. Disconnect radio antenna cable connector (2).
 c. Disconnect radio connector (3).
 d. Disconnect CB antenna cable connector (4).
 e. Disconnect CB module connector (5).
 f. Remove screw to release flange of CB module from radio. Remove CB module.
5. See Figure 7-84. remove four screws to release radio (storage box on FLHT) from radio support brackets.
6. Pull radio (storage box on FLHT) forward to remove from opening in inner fairing.



1. **Radio [27]**
2. **Radio antenna cable [51]**
3. **Radio [28]**
4. **CB antenna cable [50]**
5. **CB module [184]**

Figure 7-83. Radio/CB Connections (FLHTC/U)

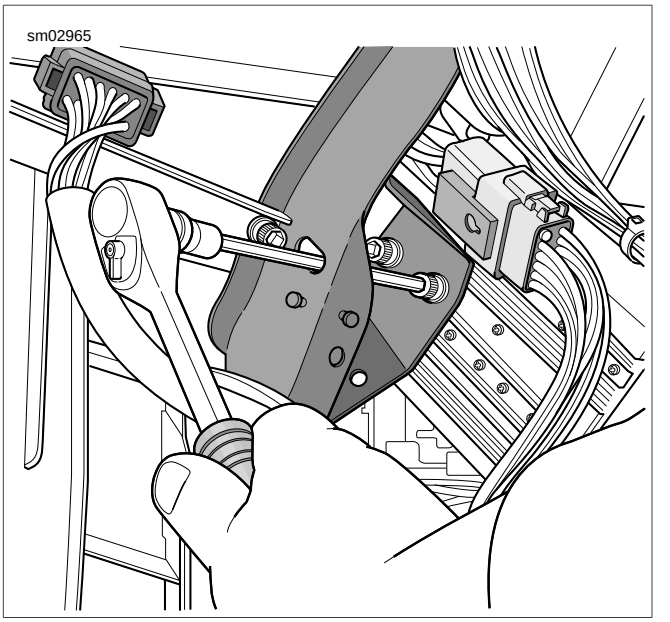


Figure 7-84. Release Radio from Fairing Brackets (FLHTC/U)

Installation

1. Position radio (storage box on FLHT) between radio support brackets and push into opening in inner fairing.
2. Starting at the rear, install four screws and tighten to 35-45 **in-lbs** (4.0-5.1 Nm).
3. **FLHX, FLHTC, FLTR:**
 a. See Figure 7-83. Connect radio connector (1).
 b. Connect radio antenna cable connector (2).
4. **FLHTCU:**
 a. See Figure 7-83. Fit CB module into rubber grommets at top left side of radio.
 b. Fasten flange of CB module to radio and tighten screw to 35-45 **in-lbs** (4.0-5.1 Nm).
 c. Connect radio connector (3).
 d. Connect CB antenna cable connector (4).
 e. Connect CB module connector (5).
 f. Connect radio connector (1).
 g. Connect radio antenna cable connector (2).
5. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
6. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

FRONT FAIRING SPEAKERS

Removal

1. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
2. Carefully pull socket terminals from speaker spade contacts.
3. Remove three screws to release speaker adapter assembly from inner fairing.
4. Carefully pull speaker from adapter.

Installation

1. With the speaker spade contacts at the top of the adapter, the top being the side with the widest edge, snap speaker into adapter using finger pressure.
2. If speaker grille is loose, apply 3M-847 adhesive (HD Part No. 99618-60) to outer edge of adapter ring. Install grille on adhesive.
3. With the widest edge of adapter at the top, align holes in speaker adapter assembly with those in inner fairing.
4. Start two long screws to secure top of speaker adapter assembly to inner fairing. Capturing fairing support brace, install short screw in lower outboard hole (positioning flat washer between adapter and support brace). The screw hole on the lower inboard side is not used.
5. Tighten lower speaker screw to 22-28 **in-lbs** (2.5-3.2 Nm). Tighten two upper speaker screws to 35-50 **in-lbs** (4.0-5.7 Nm).
6. Install socket terminals onto speaker spade contacts. Different size spade contacts prevent improper assembly.
7. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.

FRONT HEADSET RECEPTACLE

NOTE

The following instructions may also be used for replacement of the fuel tank console on which the front headset receptacle is mounted.

Removal

1. Remove seat. See 2.28 SEAT.
2. Remove left side saddlebag. See 2.29 SADDLEBAGS.
3. Remove left side cover.
4. Carefully cut two cable straps securing headset receptacle conduit and audio harness to inboard side of left upper frame tube (front and rear of saddlebag rail).
5. Release console connector [53], 12-place Deutsch, from attachment clip anchored in hole of frame crossmember (at rear of battery). Disconnect pin and socket halves.
6. Remove socket screw to release front of console from fuel tank weldment.
7. Remove hex screw to release rear console bracket from clip nut on rear fuel tank bracket.
8. Lay a clean shop towel on forward part of rear fender.
9. Press button to open fuel door on console. Remove filler cap. Remove console bending back flexible metal clips as necessary to release wire harness and front headset receptacle conduit.
10. Lay console upside down on shop towel. Install filler cap.
11. See Figure 7-85. Raise headset receptacle cap. Place pin punch in either notch of lock ring and rotate in a counterclockwise direction until loose.
12. Remove lock ring and cap from headset receptacle.
13. Remove headset receptacle from console.

Installation

1. Insert threaded end of headset receptacle through hole in console.
2. Slide receptacle cap over threaded end of headset receptacle.
3. Open cap, and with the notches on the outboard side, thread lock ring onto headset receptacle.
4. See Figure 7-85. Place pin punch in either notch of lock ring and rotate in a clockwise direction until tight.
5. Remove filler cap, if installed. Position console on fuel tank bending flexible metal clips as necessary to capture

wire harness and front headset receptacle conduit. Install filler cap.

6. Start socket screw to fasten front of console to fuel tank weldment.
7. Start hex screw to fasten rear console bracket to clip nut on rear fuel tank bracket.
8. Alternately tighten socket/hex screws to 36-60 **in-lbs** (4.1-6.8 Nm).
9. Connect console connector [53], 12-place Deutsch. Install connector onto attachment clip anchored in hole of frame crossmember (at rear of battery).
10. Install two **new** cable straps to secure headset receptacle conduit and audio harness to inboard side of left upper frame tube (front and rear of saddlebag rail).
11. Install left side cover.
12. Install left side saddlebag. See 2.29 SADDLEBAGS.
13. Install seat. See 2.28 SEAT.
14. Test operation of headset receptacle.

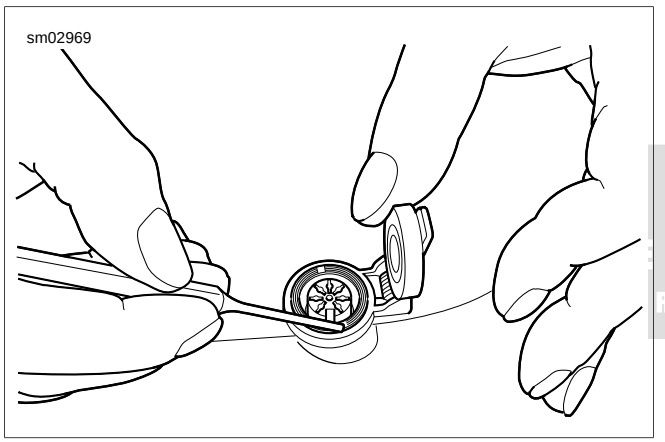


Figure 7-85. Remove Lock Ring from Receptacle

REAR HEADSET RECEPTACLE

Replace audio harness. See 7.38 AUDIO HARNESS: FLHTCU.

REAR PASSENGER SWITCHES

Removal

NOTE

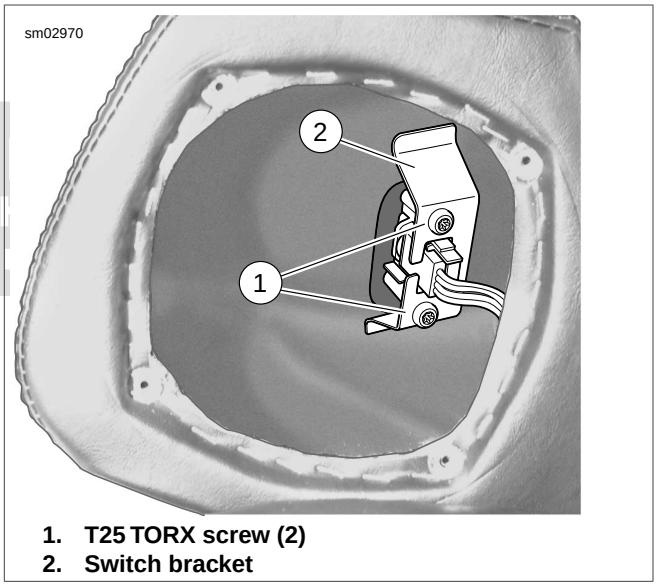
Right and left side replacement passenger switch assemblies are interchangeable.

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Open Tour-Pak.
3. Remove four screws and pull speaker grille from speaker box.
4. Remove speaker from speaker box and carefully pull socket terminals from speaker spade contacts.
5. Remove trim ring and gently pull on wire harness to draw rear speaker/passenger controls connector, 6-place Deutsch, out of speaker box.
6. Disconnect pin and socket halves of connector.
7. Draw socket housing back into speaker box and pull out through speaker hole.
8. See Figure 7-86. Remove two screws to release switch bracket from inside of speaker box. Remove bracket using slot to free switch wires.
9. Pull switch housing assembly, wire harness, speaker terminals and socket housing from speaker box using switch housing hole on outboard side.
10. Carefully pull keycap from switch shaft. Remove switch from switch housing.
11. Remove terminals 1 through 4 from socket housing.

NOTE

For instructions on properly removing wire terminals, see A.5 DEUTSCH ELECTRICAL CONNECTORS.

12. Pulling one wire at a time, draw four switch wires from conduit.



1. **T25 TORX screw (2)**
2. **Switch bracket**

Figure 7-86. Remove Passenger Switch Assembly

Installation

1. Inserting one wire at a time, push four switch wires through conduit.
2. Install terminals into socket housing. Refer to Table 7-16.

Table 7-16. Rear Passenger Switches [41/42]

WIRE COLOR	CHAMBER NUMBER
Pink/White	1
Gray/White	2
Violet/Black	3
*Orange/Black	4
* Mates to O/BK on [41A], BN/W on [42A].	

NOTE

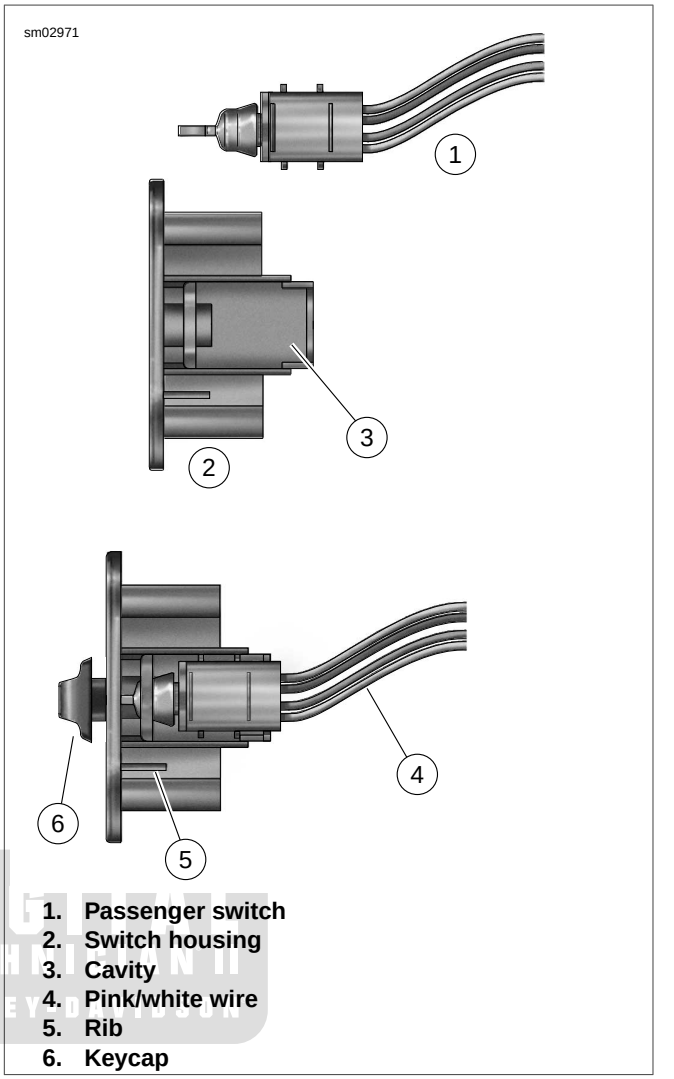
For instructions on properly installing wire terminals, see A.5 DEUTSCH ELECTRICAL CONNECTORS.

3. See Figure 7-87. With the Pink/White wire at the bottom, place switch in cavity of switch housing. Bottom of assembly is determined by location of rib on switch housing.
4. Note lettering for proper orientation and gently push keycap onto switch shaft. When orienting keycap, remember that bottom of assembly is determined by location of switch housing rib.
5. Feed socket housing, speaker terminals and wire harness through switch housing hole on outboard side of speaker box until switch housing backplate contacts speaker box. Pull wire harness out through speaker hole.

NOTE

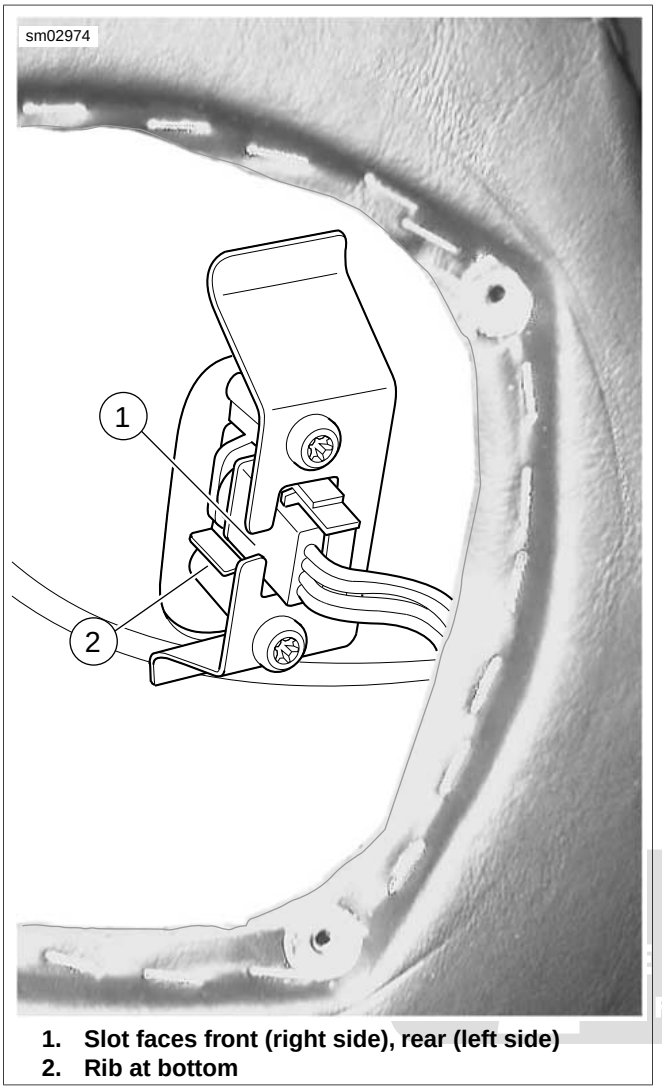
See Figure 7-88. To align bracket and switch housing holes, slot in bracket must face toward the front on right side switch assembly and toward the rear on left side switch assembly. Switch also must be square in cavity of switch housing or bracket will not fit.

6. Reaching into speaker box, align holes in bracket with holes in switch housing. Install two screws.
7. Feed socket housing through speaker hole into speaker box and pull out through harness hole on inboard side.
8. Mate pin and socket halves of connector. Feed connector back up into speaker box pressing trim ring into hole.
9. Install socket terminals onto speaker spade contacts. Different size spade contacts prevent improper assembly.
10. Align holes in speaker grille with those in speaker and slide four screws through grille and speaker holes.
11. With spade contacts at bottom rear corner, position speaker/grille assembly against speaker box. Start screws into speaker box and alternately tighten in a crosswise pattern.
12. Close Tour-Pak.
13. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
14. Test switch for proper operation.



1. **Passenger switch**
2. **Switch housing**
3. **Cavity**
4. **Pink/white wire**
5. **Rib**
6. **Keycap**

Figure 7-87. Install Switch in Housing



1. **Slot faces front (right side), rear (left side)**
2. **Rib at bottom**

Figure 7-88. Install Passenger Switch Assembly

REAR SPEAKERS

Removal

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Open Tour-Pak.
3. Remove four screws from speaker grille. Remove speaker grille from speaker box.
4. Remove speaker from speaker box. Carefully pull two socket terminals from speaker spade contacts.

Installation

1. Install two socket terminals onto speaker spade contacts. Different size spade contacts prevent improper assembly.
2. With spade contacts at bottom, install speaker in speaker box.
3. Align holes in speaker with those in speaker box. Align holes in grille with those in speaker.
4. Install four screws and alternately tighten in a crosswise pattern.
5. Close Tour-Pak.
6. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
7. Test speaker for proper operation.

CB MODULE

Removal

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
3. See Figure 7-83. Disconnect the following:
 a. CB antenna cable connector [50].
 b. CB module connector [184], 12-place Deutsch (black).
4. Remove screw to release flange of CB module from radio. Remove CB module.

Installation

1. Fit metal cones on CB module into rubber grommets at top of radio. Use the position above radio connector [28], 35-place Amp, as the other location has been reserved for certain P&A accessories.
2. Install screw to fasten flange of CB module to radio. Tighten screw to 35-45 **in-lbs** (4.0-5.1 Nm).
3. See Figure 7-83. Connect the following:
 a. CB antenna cable connector [50].
 b. CB module connector [184], 12-place Deutsch (black).
4. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
5. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

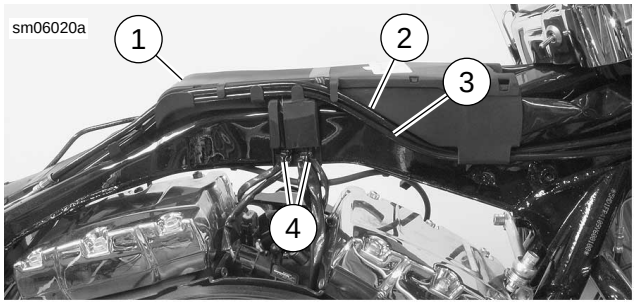
WIRE TROUGH 7.34

REMOVAL

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Remove fuel tank. See 4.5 FUEL TANK.
3. Remove T-MAP sensor connector [80].
4. Remove front [84] and rear [85] fuel injector connectors.
5. Remove TCA connector [211]. Cut anchored cable strap to release connector conduit from front side of induction module.
6. Disconnect elbow terminals from spade contacts on horn and release harness conduit from J-clamp.
7. Pull back boot and disconnect ET sensor connector [90].
8. Draw connectors removed in previous steps to right side of motorcycle.
9. See Figure 7-89. On ABS equipped motorcycles, release brake lines (2, 3) from wire trough.
10. Cut two cable straps (4) to release breakout harnesses from right side of wire trough.
11. Release catches on cover and remove cover (1).
12. See Figure 7-90. Using a paint pen, draw a line on each wire bundle on both sides of each cable strap.

NOTE

Note that there are a total of ten cable straps. Eight cable straps fix the position of the harness(es) inside the wire trough, while two more fix the position of the breakouts on the right side.

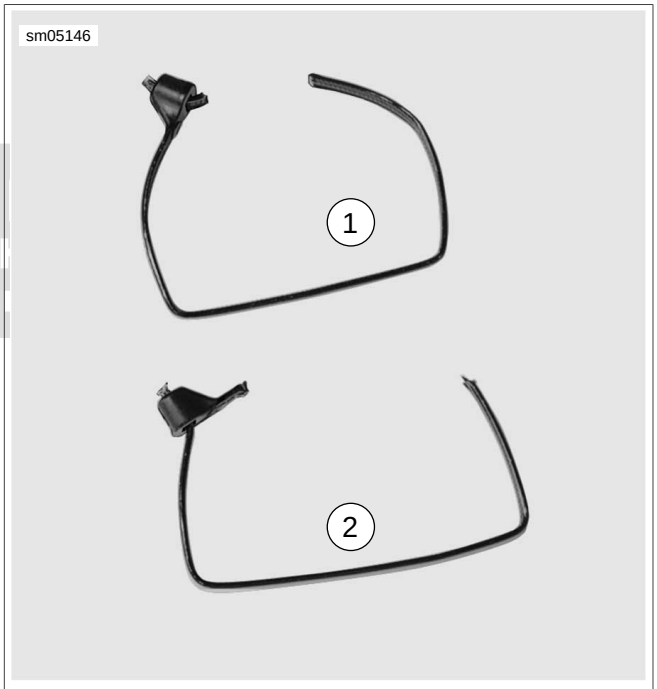


1. **Wire trough cover**
2. **Front master cylinder-to-ABS module line**
3. **ABS module-to-front caliper line**
4. **Breakout harness cable straps**

Figure 7-89. Wire Trough and Brake Lines



Figure 7-90. Mark Location of Cable Straps



1. **Reusable (tail removed)**
2. **Not reusable (eyelet removed)**

Figure 7-91. Cut Cable Straps

NOTE

See Figure 7-91. When removing cable ties, cut off the tail of the cable strap and not the eyelet. The cable strap can then be reused to gather wires when removing harness from wire trough.

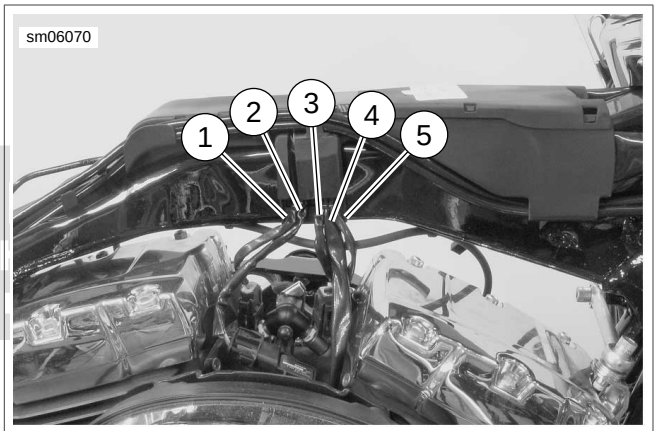
13. Cutting as close to the eyelet as possible, cut eight cable straps inside the wire trough. Remove each cable strap from slots in wire trough and remove the tail remnant from the eyelet. Install the cable strap back on the harness near

the painted lines to gather the bunch of wires. Be sure to capture each wire of the harness.

14. Pull breakout harnesses out through slot in breakout compartment. If ABS equipped, move harnesses outboard of brake lines.
15. **FLHR/C:** Remove fuel gauge harness from slot in front of wire trough.
16. Pry anchor pins at rear of wire trough from holes in frame backbone.
17. Raise wire harnesses and remove wire trough from right side of motorcycle.

INSTALLATION

1. Thread eight **new** cable straps through slots inside wire trough.
2. Raise wire harnesses and slide wire trough into position on frame backbone from right side of motorcycle.
3. **FLHR/C:** Route the fuel gauge harness through slot in front-left of wire trough.
4. See Figure 7-92. Install rear fuel injector and T-MAP sensor breakout harnesses in the rear of the breakout compartment and install a **new** cable tie but do not tighten cable tie.
5. Install front fuel injector, horn/ET sensor and TCA breakout harnesses in the front of the breakout compartment and install a **new** cable tie but do not tighten cable tie.
6. Pull breakout harnesses inboard of brake lines on ABS equipped vehicles.
7. Adjust harness wires inside wire trough, so they are positioned within the eight cable straps. Engage each cable strap but do not tighten.
8. Remove the cable straps used to gather the wire bunches.
9. Route main harness and audio harness (if equipped) through front-left channel of wire trough.
10. Route main harness through front-right channel of wire trough.
11. Push anchor pins at rear of wire trough into holes in frame backbone.
12. Make final adjustments to harnesses so that the painted lines are aligned with the cable straps. Tighten cable straps and cut excess cable strap material.
13. Pull on each harness exiting the breakout compartment until painted lines are aligned with cable straps. Tighten cable straps and cut excess cable strap material.
14. Secure cover to wire trough starting at the rear and working forward. Verify that all latches are fully engaged.
15. **ABS equipped motorcycles:** Secure brake line as shown in Figure 7-89.
16. Install T-MAP sensor connector, rear fuel injector connector, front fuel injector connector, ET sensor connector, and elbow terminals onto horn spade contacts. Capture horn harness conduit in J-clamp.
17. Install TCA connector. Install **new** anchored cable strap in hole at front right side of induction module and secure harness. Cut excess cable strap material.
18. Install fuel tank. See 4.5 FUEL TANK.
19. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.



1. **Rear fuel injector**
2. **T-MAP sensor**
3. **Horn/ET sensor**
4. **TCA**
5. **Front fuel injector**

Figure 7-92. Breakout Harnesses

MAIN WIRING HARNESS 7.35

REMOVAL: ALL MODELS (PART 1)

1. Remove fuel tank. See 4.5 FUEL TANK.
2. Remove battery. See 1.17 BATTERY MAINTENANCE.
3. Remove saddlebags. See 2.29 SADDLEBAGS.
4. Remove right side cover.

NOTE

Depending upon model, continue procedure at 7.35 MAIN WIRING HARNESS, Removal: FLHR/C (Part 2), 7.35 MAIN WIRING HARNESS, Removal: FLHX, FLHT/C/U (Part 2) or 7.35 MAIN WIRING HARNESS, Removal: FLTR (Part 2).

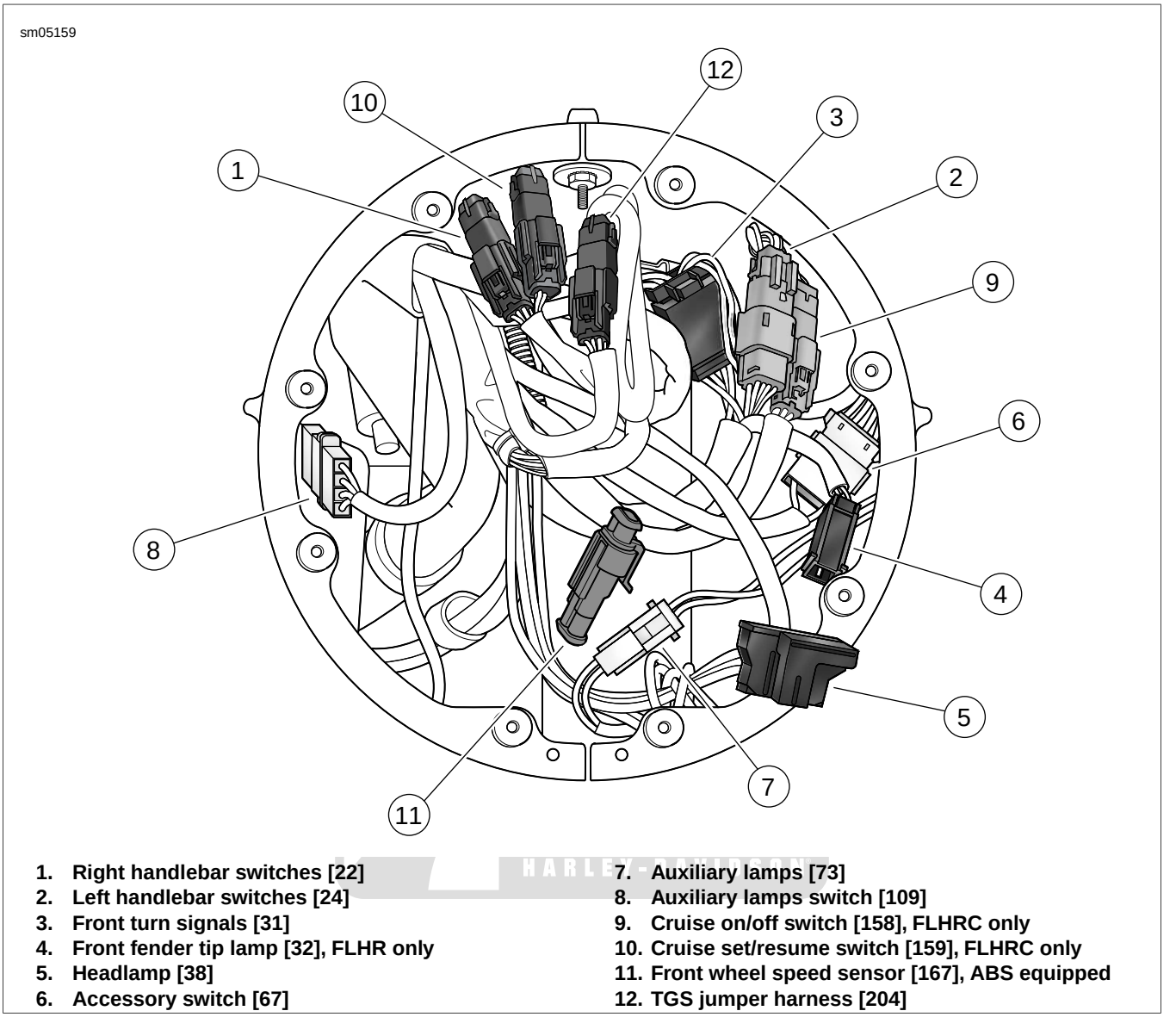
REMOVAL: FLHR/C (PART 2)

1. Remove headlamp assembly. See 7.11 HEADLAMP: ALL EXCEPT FLTR.
2. See Figure 7-93. Reaching inside headlamp nacelle, disconnect connectors and remove from their retaining devices, if present:
 a. Auxiliary lamps [73], 2-place Multilock (white).
 b. Auxiliary lamps switch [109], 4-place Amp.
 c. Right handlebar switches [22], 6-place Molex (black).
 d. Cruise set/resume switch [159], 3-place Molex (black); used on FLHRC only.
 e. Twist grip sensor jumper harness [204], 6-place Molex (black).
3. Remove screw and P-clamp to release main harness conduit from right side of steering head.
4. Carefully pull main harness rearward under right side of headlamp nacelle allowing conduit and connectors to hang over top of engine guard.
5. Reaching inside headlamp nacelle, disconnect connectors and remove from their retaining devices, if present:
 a. Front fender tip lamp jumper harness [32], 2-place Multilock (black); used on FLHR only.
 b. Accessory switch [67], 4-place Amp.
 c. Front turn signal lamps [31], 6-place Multilock.
 d. Left handlebar switches [24], 8-place Molex (gray).
 e. Cruise on/off switch [158], 3-place Molex (gray); used on FLHRC only.
 f. Front wheel speed sensor [167], 2-place Amp (Tyco); used on ABS equipped motorcycles only.
6. Remove screw and P-clamp to release main harness conduit from left side of steering head.
7. Carefully pull main harness rearward under left side of headlamp nacelle allowing conduit and connectors to hang over top of engine guard.

NOTE

Continue procedure at 7.35 MAIN WIRING HARNESS, Removal: All Models (Part 3).

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1. **Right handlebar switches [22]**
2. **Left handlebar switches [24]**
3. **Front turn signals [31]**
4. **Front fender tip lamp [32], FLHR only**
5. **Headlamp [38]**
6. **Accessory switch [67]**
7. **Auxiliary lamps [73]**
8. **Auxiliary lamps switch [109]**
9. **Cruise on/off switch [158], FLHRC only**
10. **Cruise set/resume switch [159], FLHRC only**
11. **Front wheel speed sensor [167], ABS equipped**
12. **TGS jumper harness [204]**

Figure 7-93. Headlamp Nacelle- Main Harness Connectors (FLHR/C)

REMOVAL: FLHX, FLHT/C/U (PART 2)

PART NUMBER	TOOL NAME
HD-45961	IGNITION SWITCH CONNECTOR REMOVER

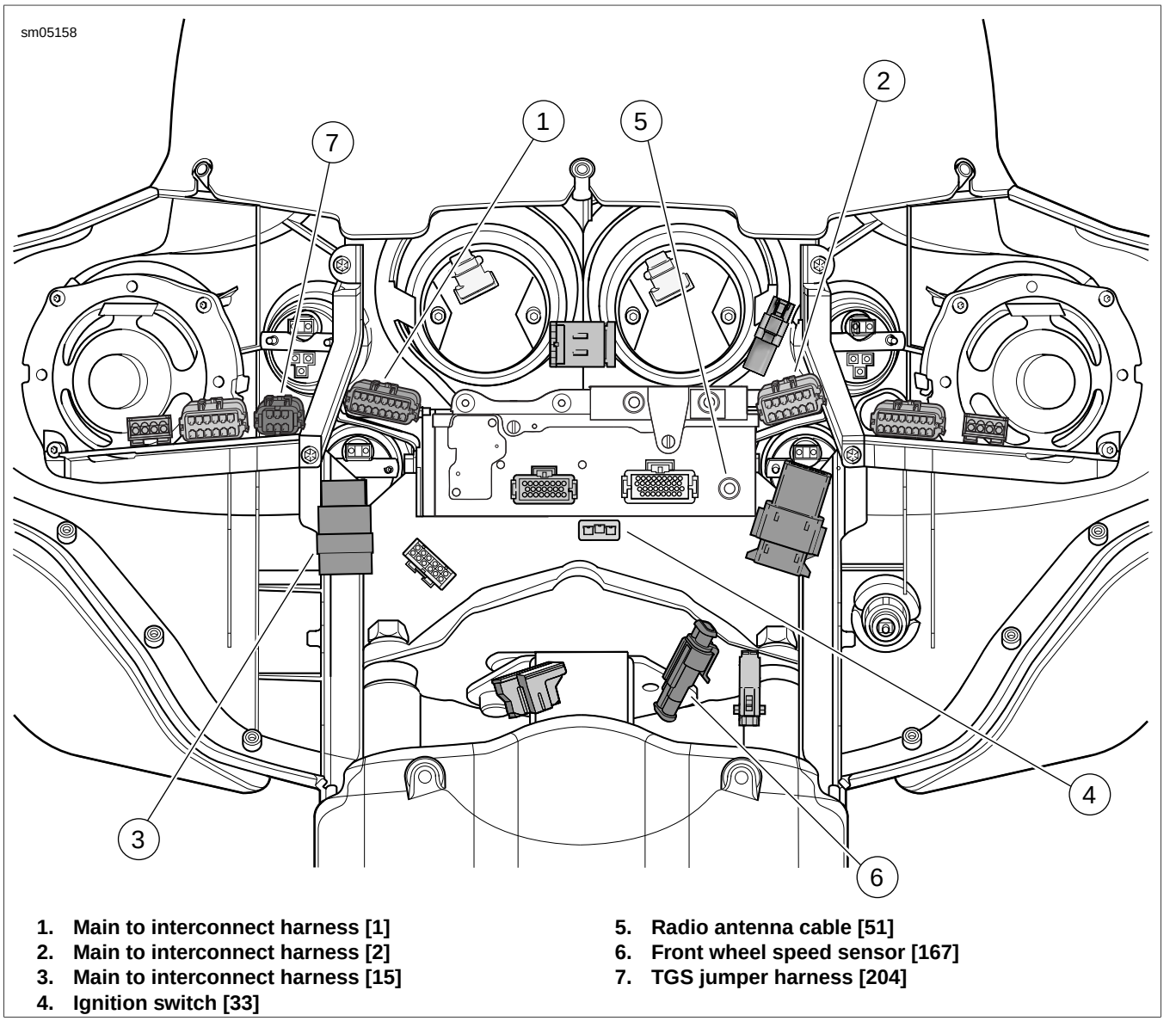
1. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
2. Cut cable strap to release conduit of main to interconnect harness connector [1] and main to interconnect harness connector [15] from right fairing bracket.
3. See Figure 7-94. Disconnect connectors and remove from their retaining devices, if present.
 a. Twist grip sensor jumper harness [204], 6-place Molex (black)); T-stud on right fairing support brace (inboard side).
 b. Main to interconnect harness [1], 16-place Molex (black); anchor in hole of right radio support bracket.
 c. Main to interconnect harness [15], 4-place Packard (black); anchored in hole at front of right fairing bracket.
 d. Radio antenna cable connector [51]; back of radio (left side).

4. Disconnect ignition switch connector [33], 3-place Packard, at front of ignition switch housing. Proceed as follows:
 a. Using a long shank ball end socket (Snap-on® FABL6E), remove four screws to release radio (storage box on FLHT) from left and right radio support brackets. Use oblong holes in fairing brackets to access screws.
 b. Remove anchor on ignition switch connector conduit from hole in bottom right corner of radio.
 c. Obtain the IGNITION SWITCH CONNECTOR REMOVER (Part No. HD-45961).
 d. Lift radio slightly and gently insert end of tool into slot in ignition switch housing until it stops.
 e. Grasping main harness conduit and tool, pull both at the same time to release socket housing from ignition switch housing.
5. Remove screw and P-clamp to release main harness from right side of steering head.
6. Carefully pull main harness conduit rearward under right side of fairing cap allowing conduit and connectors to hang over top of engine guard.
7. Cut cable strap to release conduit of main to interconnect harness connector [2] from left fairing bracket.
8. See Figure 7-94. Disconnect connectors and remove from their retaining devices, if present.
 a. Main to interconnect harness [2], 12-place Molex (gray); anchor in hole of left radio support bracket.
 b. Front wheel speed sensor [167], 2-place Amp (Tyco); below upper fork bracket (left side); used on ABS equipped motorcycles only.
9. Remove screw and P-clamp to release main harness (and audio harness on FLHTCU) from left side of steering head.
10. Carefully pull main harness conduit rearward under left side of fairing cap allowing conduit and connectors to hang over top of engine guard.
11. Disconnect audio harness on FLHTCU models. See 7.38 AUDIO HARNESS: FLHTCU, steps 6-7.

NOTE

Continue procedure at 7.35 MAIN WIRING HARNESS, Removal: All Models (Part 3).

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1. **Main to interconnect harness [1]**
2. **Main to interconnect harness [2]**
3. **Main to interconnect harness [15]**
4. **Ignition switch [33]**
5. **Radio antenna cable [51]**
6. **Front wheel speed sensor [167]**
7. **TGS jumper harness [204]**

Figure 7-94. Inner Fairing- Main Harness Connectors (FLHX, FLHT/C/U)

REMOVAL: FLTR (PART 2)

Remove inner fairing. See 2.44 INNER FAIRING: FLTR.

NOTE

Continue procedure at 7.35 MAIN WIRING HARNESS, Removal: All Models (Part 3).

REMOVAL: ALL MODELS (PART 3)

1. Remove air cleaner and backplate. See 4.4 AIR CLEANER ASSEMBLY.
2. See Figure 7-95. Remove connectors from induction module. Proceed as follows:
 a. Remove T-MAP sensor connector [80].
 b. Remove front fuel injector connector [84] and rear fuel injector connector [85].
 c. Remove TCA connector [211]. Cut anchored cable strap to release connector conduit from front right side of induction module.
3. Remove horn bracket screws (with flat washers) to remove horn and bracket from cylinder heads. Remove elbow terminals from horn spade contacts and release conduit from J-clamp.
4. Pull back boot at back of front cylinder and remove ET sensor connector [90].
5. Draw conduit and connectors to right side of motorcycle.

6. **ABS equipped motorcycles:** release brake lines from clips in wire trough.
7. Remove purge solenoid connector [95], 2-place Packard. If not equipped, leave unused socket housing anchored in hole of top caddy.
8. Disconnect ECM connector [78]. Leave ECM attached to top caddy.
9. Remove ignition coil connector [83].

NOTE

In next step, take note of ring terminal orientation. Consult wiring diagrams for proper installation.

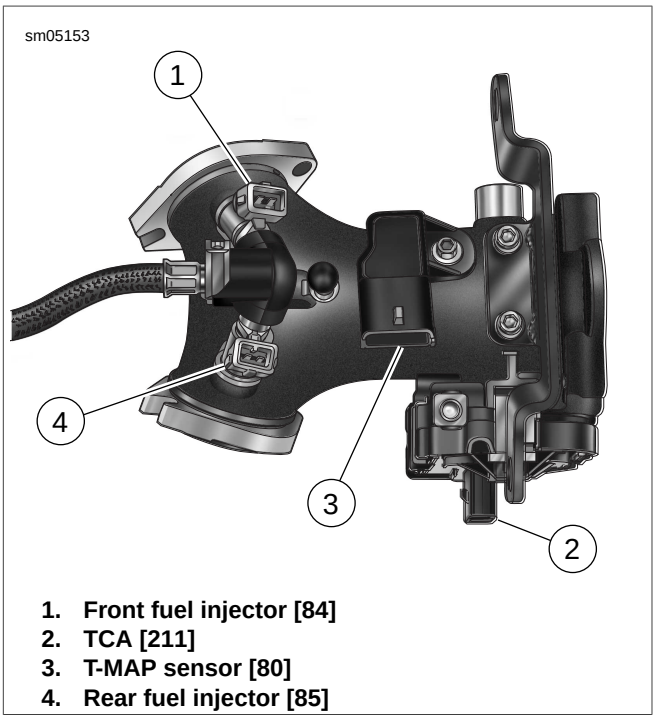
10. Remove flange nut from ground stud on left side of frame backbone. Remove main harness ground ring terminals. Repeat step to remove chassis ground ring terminal from right ground stud.
11. Pry anchor pins at rear of wire trough from holes in frame backbone.
12. Disconnect socket housing from siren, if equipped, and then push two retaining latches forward and pull siren from compartment at front of left side caddy.
13. Remove left side electrical caddy from battery tray. See 7.7 ELECTRICAL CADDIES.
14. **FLHR/C Only:**
 a. Pull anchor on ignition switch jumper harness connector [222], 4-place Packard, from hole in left caddy. Disconnect connector.
 b. Disconnect instrument console connector [20], 16-place Molex, inboard of left upper frame tube. Remove instrument console from motorcycle.
15. Pull TSM/HFSM module from battery tray. Disconnect TSM/HFSM connector [30], 12-place Deutsch. If present, disconnect HFSM antenna jumper harness connector [208] from module and remove from motorcycle.
16. Pull rear fender lights and TSM/HFSM conduit and connectors out through opening at rear of left side caddy and allow to hang at side of motorcycle.
17. **FLHX Only:**
 a. On left side of motorcycle, remove screw to remove passenger seat strap from seat strap mounting bracket.
 b. Cut cable straps to release radio antenna cable from saddlebag mounting bracket.
 c. At bottom of radio antenna bracket, rotate knurled ring to disconnect radio antenna cable connector [29].
 d. Disconnect rear fascia lamp connector [12], 3-place Multilock, inboard of upper frame tube.
 e. Draw radio antenna cable and rear fascia lamp conduit forward and then out through opening at rear of left side caddy.
18. **FLHTC/U Only:**
 a. Open Tour-Pak and proceed as follows:

 FLHTC: Remove rubber mat.

 FLHTCU: Open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.
 b. **FLHTCU models:** press latch and remove bulb socket from left side wrap-around light.
 c. Rotate knurled ring to disconnect radio antenna cable connector [29]. Release cable from two adhesive clips at bottom of Tour-Pak.
 d. **FLHTCU models:** disconnect Tour-Pak lights connector [12], 3-place Multilock.
 e. Pull grommet into Tour-Pak and remove from main harness conduit.
 f. Pull Tour-Pak lights and radio antenna cable connectors out through hole at front of Tour-Pak. Cut cable strap to release conduit from luggage rack rail.
 g. Cut two cable straps securing main harness conduit to left upper frame tube.
 h. Draw Tour-Pak lights and radio antenna cable connectors forward and then out through opening at rear of left side caddy.
 i. Disconnect audio harness on FLHTCU models. See 7.38 AUDIO HARNESS: FLHTCU.
 j. Feed conduit and connectors into battery tray and then pull out through opening at rear of left side caddy.
19. **FLTR Only:**
 a. On left side of motorcycle, remove screw to remove passenger seat strap from seat strap mounting bracket.
 b. Cut cable straps to release radio antenna cable from saddlebag mounting bracket.
 c. At bottom of radio antenna bracket, rotate knurled ring to disconnect radio antenna cable connector [29].
 d. Draw radio antenna cable forward and then out through opening at rear of left side caddy.
20. Pull back boot at top of starter housing and remove flange nut and main power cable ring terminal from post. Draw main power cable into battery tray and then out through opening at rear of left side caddy.
21. Remove starter. See 7.9 STARTER.
22. Disconnect VSS connector [65], 3-place Delphi, at top of transmission case.
23. Remove two elbow connectors from neutral switch posts.
24. Disconnect rear O2 sensor connector [137], 2-place Amp (Tyco).
25. Pull VSS, neutral switch, rear O2 sensor and starter solenoid conduit and connectors up through opening at front of battery tray and then feed branch out through opening at rear of left side caddy.

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26. **ABS Equipped Only:**
 a. Disconnect ABS module connector [166], 20-place Molex.
 b. Disconnect rear wheel speed sensor connector [168], 2-place Amp (Tyco) located on right side of battery tray.
 c. Feed conduit and connectors into battery tray.
27. Disconnect voltage regulator. See 7.3 VOLTAGE REGULATOR.
28. Locate CKP sensor connector [79], 2-place Deutsch, fixed to front caddy at bottom of lower frame crossmember. Push connector toward right side of motorcycle to disengage attachment clip from T-stud. Disconnect connector.
29. Push anchor on jiffy stand interlock sensor connector [133], 3-place Molex, from hole in front caddy. Disconnect connector.
30. Locate oil pressure switch/sender at front right side of crankcase. On FLHR/C models, pull elbow from post of oil pressure switch. On FLHX, FLHT/C/U and FLTR models, remove Delphi connector from oil pressure sender.
31. Remove O2 sensor connector [138] wiring from clamps at back of cross brace between front frame downtubes. Disconnect connector, 2-place Amp (Tyco).
32. Pull conduit clamp from hole to free main harness conduit from inboard side of front engine mounting bracket.
33. Cut cable straps to free rear brake line and main harness conduit from two rubber saddles anchored on T-studs at top of lower frame tube.
34. Pull two socket terminals from spade contacts on rear brake light switch. Cut cable strap to free rear brake light switch wires from lower frame tube.
35. Cut cable strap at rear of rear brake light switch bracket to release main harness conduit from middle frame downtube.
36. Cut cable straps from holes in frame near rear swingarm bracket to release main harness conduit.
37. Disconnect active exhaust valve actuator connector [179], 5-place Amp (Tyco). If active exhaust valve actuator is not provided, disconnect unused socket housing from mock pin housing on right side of battery tray.
38. Pull rear brake light switch, oil pressure switch/sender, CKP sensor, jiffy stand interlock sensor, voltage regulator and front O2 sensor conduit and connectors rearward, and then up through opening at front of battery tray. Feed branch into battery tray pulling it out through opening at rear of left side caddy.
39. While pulling left side caddy away from motorcycle, feed rear end of wire trough out through opening between frame downtubes.



1. **Front fuel injector [84]**
2. **TCA [211]**
3. **T-MAP sensor [80]**
4. **Rear fuel injector [85]**

Figure 7-95. Induction Module Assembly (Top View)

INSTALLATION: ALL MODELS (PART 1)

1. From left side of motorcycle, feed front end of wire trough in through opening between frame downtubes, and then pull up and out through opening at top of battery tray. Lay wire trough on top of frame backbone.
2. Push anchor pins at rear of wire trough into holes in frame backbone.
3. Locate branch of main harness terminating in the active exhaust valve actuator, rear brake light switch, oil pressure switch/sender, CKP sensor, jiffy stand interlock sensor, voltage regulator, TSM/HFSM and front O2 sensor connectors. Feed harness in through opening at rear of left side caddy, and then down through opening at front of battery tray to bottom of frame downtube. Route harness to front of motorcycle following inboard side of lower frame tube.
4. Locate branch terminating in the VSS, neutral switch, rear O2 sensor and starter solenoid connectors. Feed harness in through opening at rear of left side caddy, and then down through opening at front of battery tray to top of transmission.
5. If ABS equipped, locate branch terminating in the ABS module and rear wheel speed sensor connectors. Feed harness in through opening at rear of left side caddy and then pull out through opening at right side of battery tray.
6. Locate branch terminating in the Tour-Pak lights and radio antenna cable connectors. Feed harness in through opening at rear of left side caddy and then pull up and out through opening between frame crossmember and front of rear fender. Lay harness across left side of rear fender.

7. **FLHTCU Only:**
 a. Locate branch of audio harness terminating in the CB antenna cable, console and rear speaker/passenger controls connectors. Feed harness in through opening at rear of left side caddy and then pull up and out through opening at top of battery tray and lay across right side of rear fender.
 b. Locate branch terminating in the rear headset receptacle and rear speaker/passenger controls connector. Feed harness in through opening at rear of left side caddy and then pull up and out through opening at top of battery tray and lay across left side of rear fender.
8. Feeding main power cable ring terminal, B+, accessory, rear fender lights, purge solenoid and ignition coil connectors and conduit inboard, seat left side caddy on weldment between frame downtubes.
9. Install left side electrical caddy to battery tray. See 7.7 ELECTRICAL CADDIES.
10. Move main power cable ring terminal to front of battery tray and then feed down through opening to top of transmission.
11. Tuck B+ and accessory connectors and conduit into corner at front of battery tray. Move rear fender lights and TSM/HFSM connectors and conduit under frame crossmember at rear of battery tray.
12. Connect VSS connector [65], 3-place Delphi, at top of transmission case.
13. Install two elbow connectors onto neutral switch posts.
14. Install starter. See 7.9 STARTER.
15. Connect rear O2 sensor connector [137], 2-place Amp (Tyco), and tuck under chrome starter cover.
16. Install purge solenoid connector [95]. If purge solenoid is not provided, install anchored cable strap on socket housing into hole in wire trough (below breakout compartment).
17. Install ignition coil connector [83].
18. See Figure 7-96 for harness retention points.
 a. Secure main harness conduit to frame.
 b. Install two socket terminals onto spade contacts of rear brake light switch. Install **new** cable straps to secure rear brake light switch wires to harness.

NOTE

Replace conduit clips if damaged, deteriorated or missing. With the slotted side up, push hole in conduit clip over T-stud to install.

19. Route main harness conduit inboard of front engine mounting bracket. Install anchor capturing main harness conduit in lower frame tube.
20. Connect front O2 sensor connector [138], 2-place Amp (Tyco). Install O2 sensor wiring into clamps at back of cross brace between front frame downtubes.
21. Connect and install voltage regulator. See 7.3 VOLTAGE REGULATOR.
22. Connect CKP sensor connector [79]. Push anchor on connector into hole in front caddy.
23. Connect jiffy stand interlock sensor connector [133], 3-place Molex. Place large end of slot on attachment clip over T-stud on front caddy at bottom of lower frame crossmember.
24. Install oil pressure switch/sender connector at front right side of crankcase. On FLHR/C models, install elbow connector on post terminal. On FLHX, FLHT/C/U and FLTR models, install 4-place Delphi connector.
25. Connect active exhaust valve actuator connector [179], 5-place Amp (Tyco). If active exhaust valve actuator is not provided, connect unused socket housing to mock pin housing on right side of battery tray.
26. **ABS Equipped Only:**
 a. Connect ABS module connector [166], 20-place Molex.
 b. Connect rear wheel speed sensor connector [168], 2-place Amp (Tyco). Install anchor on rear wheel speed sensor connector into hole in right side caddy.

NOTE

For more information on antenna routing and installation, see 7.37 RADIO ANTENNA CABLE.

27. **FLHX Only:**
 a. Feed radio antenna cable and rear fascia lamp wires rearward following inboard side of upper frame tube.
 b. Mate pin and socket housings of rear fascia lamp connector [12], 3-place Multilock.
 c. Install **new** cable straps to secure rear fascia lamp wires and radio antenna cable to saddlebag mounting bracket.
 d. At bottom of radio antenna bracket, rotate knurled ring to connect radio antenna cable connector [29].
 e. Install screw to fasten passenger seat strap to seat strap mounting bracket.

NOTE

For more information on antenna routing and installation, see 7.37 RADIO ANTENNA CABLE and 7.39 CB ANTENNA CABLE: FLHTCU.

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28. **FLHTC/U Only:**
 a. Feed Tour-Pak lights and radio antenna cable connectors and conduit through hole at front of Tour-Pak. Capture cable and conduit in grommet. Install grommet in hole with the larger OD facing inside.
 b. Connect Tour-Pak lights connector [12], 3-place Multilock.
 c. Rotate knurled ring to connect radio antenna cable connector [29]. Capture cable in two adhesive clips at bottom of Tour-Pak.
 d. On FLHTCU models, install bulb socket of left side wrap-around light.
 e. Install **new** cable strap to secure main harness conduit to luggage rack rail.
 f. Connect audio harness on FLHTCU models. See 7.38 AUDIO HARNESS: FLHTCU.
 g. Proceed as follows:

 FLHTC: Install rubber mat in Tour-Pak.

 FLHTCU: Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers).

NOTE

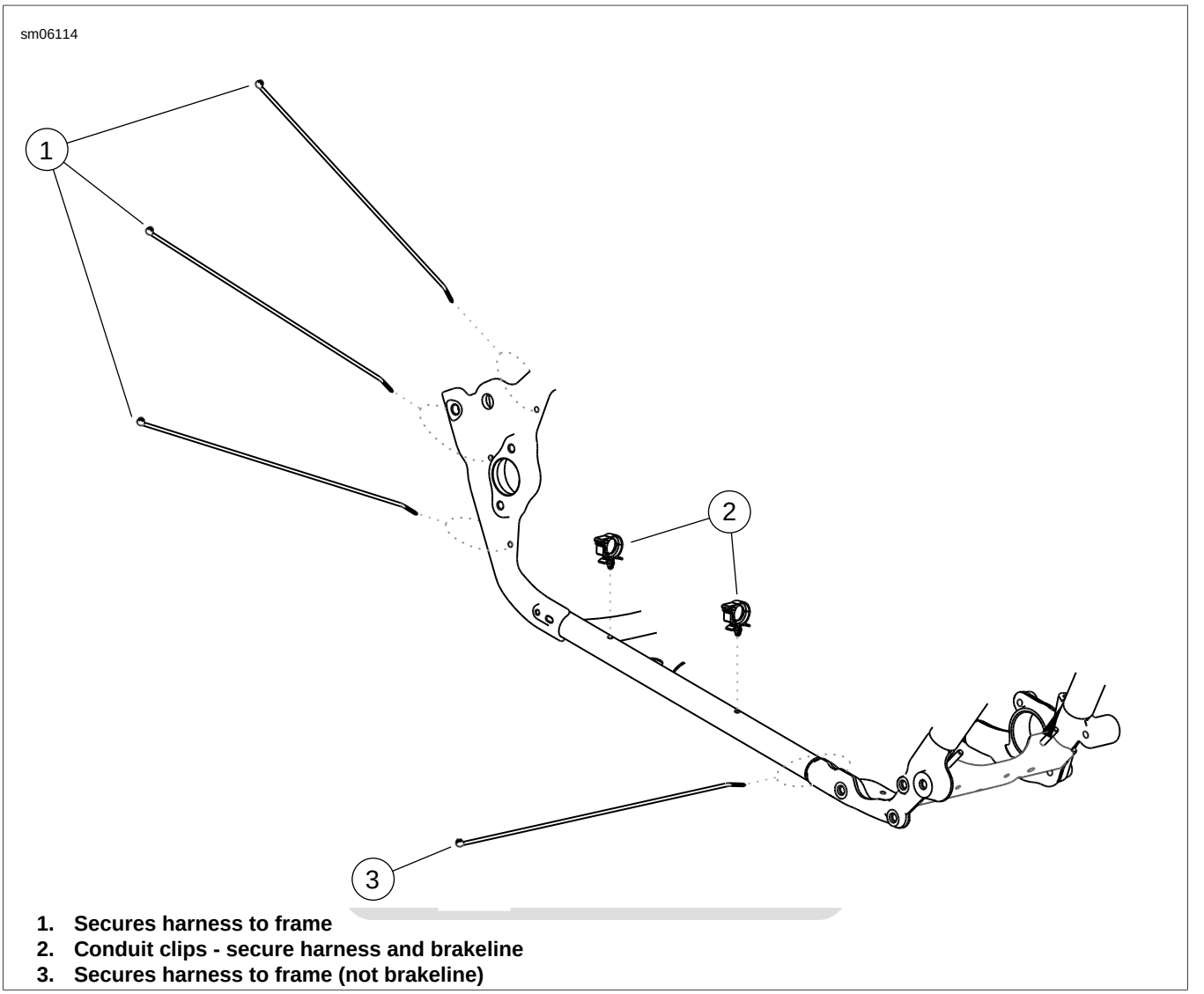
For more information on antenna routing and installation, see 7.37 RADIO ANTENNA CABLE.

29. **FLTR Only:**
 a. Feed radio antenna cable and 3-place Multilock connector (unused) rearward following inboard side of upper frame tube.
 b. Install **new** cable straps to secure rear fascia lamp wires and radio antenna cable to saddlebag mounting bracket.
 c. At bottom of radio antenna bracket, rotate knurled ring to connect radio antenna cable connector [29].
 d. Install screw to fasten passenger seat strap to seat strap mounting bracket.
30. Routing connector up between frame crossmember and rear fender, connect rear fender lights connector [7], 8-place Multilock, and attach to anchor at front of rear fender.
31. Feed TSM/HFSM connector [30] up through hole on right side of frame crossmember and connect to module. If present, feed HFSM antenna down through same hole, and then pull back up and out through empty slot of rubber boot on left side. Install module into hole in crossmember and install spring clip.
32. **FLHR/C Only:**
 a. Lay a clean shop towel on forward part of rear fender. Lay console upside down on shop towel.
 b. Connect instrument console connector [20], 16-place Molex, inboard of left upper frame tube.
 c. Connect ignition switch jumper harness connector [222], 4-place Packard. Install anchor on connector into hole in left side of battery tray.
33. Connect ECM connector [78].
34. Install two main harness ground ring terminals onto left ground stud on left side of frame backbone. Install flange nut and tighten to 50-90 **in-lbs** (5.7-10.2 Nm).
35. Route chassis ground cable forward along left side of wire trough and install ring terminal on right ground stud. Install flange nut and tighten to 50-90 **in-lbs** (5.7-10.2 Nm).
36. Install connectors to induction module as follows:
 a. Install T-MAP sensor connector [80].
 b. Install TCA connector [211]. Install **new** anchored cable strap in hole at front right side of induction module. Tighten cable strap capturing connector conduit.
 c. Install front fuel injector connector [84] and rear fuel injector connector [85].
37. Install ET sensor connector [90] at back of front cylinder. Pull boot over sensor.
38. Install elbow terminals onto horn spade contacts. Capture conduit in J-clamp. Install screw (with flat washer) to fasten horn bracket to rear cylinder head. Tighten front and rear horn bracket screws to 35-40 ft-lbs (48-54 Nm).
39. On ABS equipped motorcycles, Press brake lines into clips in wire trough.
40. Install backplate and air cleaner. See 4.4 AIR CLEANER ASSEMBLY.

NOTE

Depending upon model, continue procedure at 7.35 MAIN WIRING HARNESS, Installation: FLHR/C (Part 2), 7.35 MAIN WIRING HARNESS, Installation: FLHX, FLHT/C/U (Part 2) or 7.35 MAIN WIRING HARNESS, Installation: FLTR (Part 2).

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1. **Secures harness to frame**
2. **Conduit clips - secure harness and brakeline**
3. **Secures harness to frame (not brakeline)**

Figure 7-96. Cable Straps

INSTALLATION: FLHR/C (PART 2)

1. Route front right section of main harness forward along right side of steering head and into headlamp nacelle.
2. See Figure 7-93. Reaching inside headlamp nacelle, connect connectors and install onto their retaining devices, if present:
 a. Auxiliary lamps [73], 2-place Multilock (white).
 b. Auxiliary lamps switch [109], 4-place Amp.
 c. Right handlebar switches [22], 6-place Molex (black).
 d. Cruise set/resume switch [159], 3-place Molex (black); used on FLHRC only.
 e. Twist grip sensor jumper harness [204], 6-place Molex (black).
3. Install P-clamp and screw to fasten main harness conduit to right side of steering head.
4. Route front left section of main harness forward along left side of steering head and into headlamp nacelle.
5. Reaching inside headlamp nacelle, connect connectors and install onto their retaining devices, if present:
 a. Front fender tip lamp jumper harness [32], 2-place Multilock (black); used on FLHR only.
 b. Accessory switch [67], 4-place Amp.
 c. Front turn signal lamps [31], 6-place Multilock.
 d. Left handlebar switches [24], 8-place Molex (gray).
 e. Cruise on/off switch [158], 3-place Molex (gray); used on FLHRC only.
 f. Front wheel speed sensor [167], 2-place Amp (Tyco); used on ABS equipped motorcycles only.
6. Install P-clamp and screw to fasten main harness conduit to left side of steering head.

7. Install headlamp assembly. See 7.11 HEADLAMP: ALL EXCEPT FLTR.

NOTE

Continue procedure at 7.35 MAIN WIRING HARNESS, Installation: All Models (Part 3).

INSTALLATION: FLHX, FLHT/C/U (PART 2)

1. Route front right section of main harness forward along right side of steering head and then under fairing cap to front of inner fairing.
2. Proceed as follows:
 a. Connect ignition switch connector [33], 3-place Packard, at front of ignition switch housing.
 b. Using oblong holes in fairing brackets and a long shank ball end socket (Snap-on® FABL6E), install four screws to fasten radio (storage box on FLHT) to left and right radio support brackets. Alternately tighten screws to 35-45 **in-lbs** (4.0-5.1 Nm).
 c. Install anchor on ignition switch connector conduit into hole at bottom right corner of radio.
3. See Figure 7-94. Connect connectors and install onto their retaining devices, if present.
 a. Twist grip sensor jumper harness [204], 6-place Molex (black); T-stud on right fairing support brace (inboard side).
 b. Main to interconnect harness [1], 16-place Molex (black); anchor in hole of right radio support bracket.
 c. Main to interconnect harness [15], 4-place Packard (black); anchored in hole at front of right fairing bracket.
 d. Radio antenna cable connector [51]; back of radio (left side).
4. Using oval shaped hole at side of right fairing bracket, install **new** cable strap capturing conduit of main to interconnect harness connector [1], main to interconnect harness connector [15], right handlebar switch connector [22] and radio connector [27].
5. Install screw and P-clamp to fasten main harness to right side of steering head.
6. Route front left section of main harness (and audio harness on FLHTCU) forward along left side of steering head and then under fairing cap to front of inner fairing.
7. Connect connectors and install onto their retaining devices, if present.
 a. Main to interconnect harness [2], 12-place Molex (gray); anchor in hole of left radio support bracket.
 b. Front wheel speed sensor [167], 2-place Amp (Tyco); below upper fork bracket (left side); used on ABS equipped motorcycles only.
8. Using round hole at side of left fairing bracket, install **new** cable strap capturing conduit of main to interconnect harness connector [2], left handlebar switch connector [24] and headlamp connector [38].
9. Connect audio harness on FLHTCU models. See 7.38 AUDIO HARNESS: FLHTCU, step 7.
10. Install screw and P-clamp to fasten main harness (and audio harness on FLHTCU) to left side of steering head.
11. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

NOTE

Continue procedure at 7.35 MAIN WIRING HARNESS, Installation: All Models (Part 3).

INSTALLATION: FLTR (PART 2)

1. Install inner fairing. See 2.44 INNER FAIRING: FLTR.

NOTE

Continue procedure at 7.35 MAIN WIRING HARNESS, Installation: All Models (Part 3).

INSTALLATION: ALL MODELS (PART 3)

1. Install side covers.
2. Install saddlebags. See 2.29 SADDLEBAGS.
3. Install fuel tank. See 4.5 FUEL TANK.
4. Install battery. See 1.17 BATTERY MAINTENANCE.

DIGITAL TECHNICIAN HARLEY-DAVIDSON®

INTERCONNECT HARNESS 7.36

FLHX, FLHT/C/U

Removal

NOTE

When referencing inner fairing locations, the term "fairing bracket" refers to either the left or right vertical support, while the term "support brace" refers to either the left or right horizontal support.

1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
3. Release anchor on convoluted tubing of interconnect harness from lower ear of speedometer bracket. For best results, squeeze anchor with needle nose pliers before pulling from hole in ear. See Figure 7-97.
4. Cut cable strap to release convoluted tubing of headlamp connector [38] and conduit of main to interconnect harness connector [2] and left handlebar switch connector [24] from left fairing bracket.
5. Remove anchor on convoluted tubing of headlamp connector [38] from hole at front of left fairing bracket.
6. Cut cable strap to release convoluted tubing of radio connector [27] and conduit of main to interconnect harness connector [1], main to interconnect harness connector [15] and right handlebar switch connector [22] from right fairing bracket.
7. See Figure 7-98. Disconnect connectors and remove from their retaining devices, if present.
 a. Left front turn signal/auxiliary lamp [31L], 4-place Multilock (black); T-stud on left fairing support brace (outboard side).
 b. Left handlebar switches [24], 16-place Molex (gray); T-stud on left fairing support brace (inboard side).
 c. Main to interconnect harness [2], 12-place Molex (gray); anchor in hole of left radio support bracket.
 d. Audio to interconnect harness [6], if present; 6-place Deutsch (black); left side of radio.
 e. Indicator lights [21]; 10-place Multilock (black); above radio (between speedometer and tachometer gauges).
 f. Speedometer [39]; 12-place Packard; back of speedometer. Unthread rubber boot from odometer reset switch and pull switch from hole in inner fairing.
 g. Tachometer [108]; 12-place Packard; back of tachometer.
 h. Main to interconnect harness [1], 16-place Molex (black); anchor in hole of right radio support bracket.
 i. Right handlebar switches [22], 12-place Molex (black); T-stud on right fairing support brace (middle).
 j. Right front turn signal/auxiliary lamp [31R], 4-place Multilocks (black); T-stud on right fairing support brace (outboard side).
 k. Main to interconnect harness [15], 4-place Packard (black); anchored in hole at front of right fairing bracket.
 l. Fairing cap switches [105], 12-place Multilock (black); top of upper fork bracket (right side).
 m. Radio [27], 23-place Amp (black); back of radio (right side).
 n. Front fender tip lamp jumper harness [32], if present; 2-place Multilock (black); below upper fork bracket (left side).
 o. Ambient temperature sensor [107], if present; 3-place Multilock (black); anchored in hole on left side of steering head.
8. See Figure 7-99. Remove left side connectors from spade contacts as follows:
 a. Cigarette lighter [132].
 b. Left front speaker [35].
 c. Fuel gauge [117] and lamp [116].
 d. Air temperature gauge [115] and lamp [114], if present.
9. Feed left front turn signal/auxiliary lamp [31L], left handlebar switch [24], left side speaker, fuel gauge, air temperature gauge (if present), and cigarette lighter con-

duit and connectors to mid section of inner fairing (area between left and right fairing brackets).

10. Pull harness ground socket terminal from spade contact fastened to top of upper fork bracket (left side).
11. Remove right side connectors from spade contacts as follows:
 a. Right front speaker [34].
 b. Voltmeter gauge [111] and lamp [110].
 c. Oil pressure gauge [113] and lamp [112], if present.
12. Feed right front turn signal/auxiliary lamp [31R], right handlebar switch [22], right side speaker, voltmeter gauge, and oil pressure gauge (if present) conduit and connectors to mid section of inner fairing (area between left and right fairing brackets).
13. Remove interconnect harness from motorcycle.

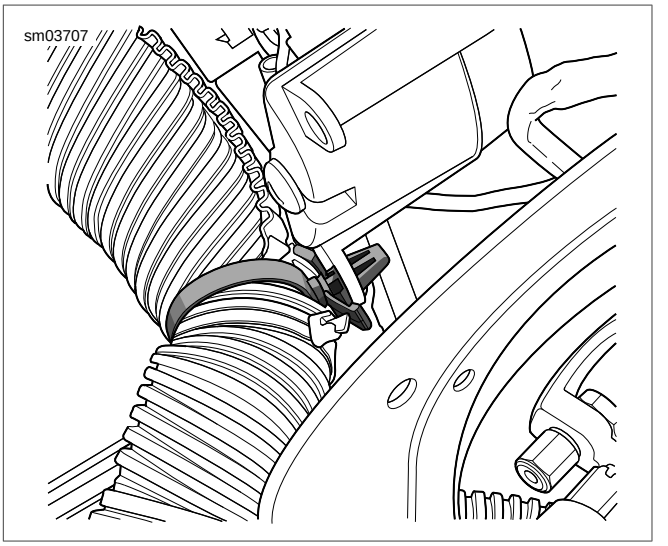
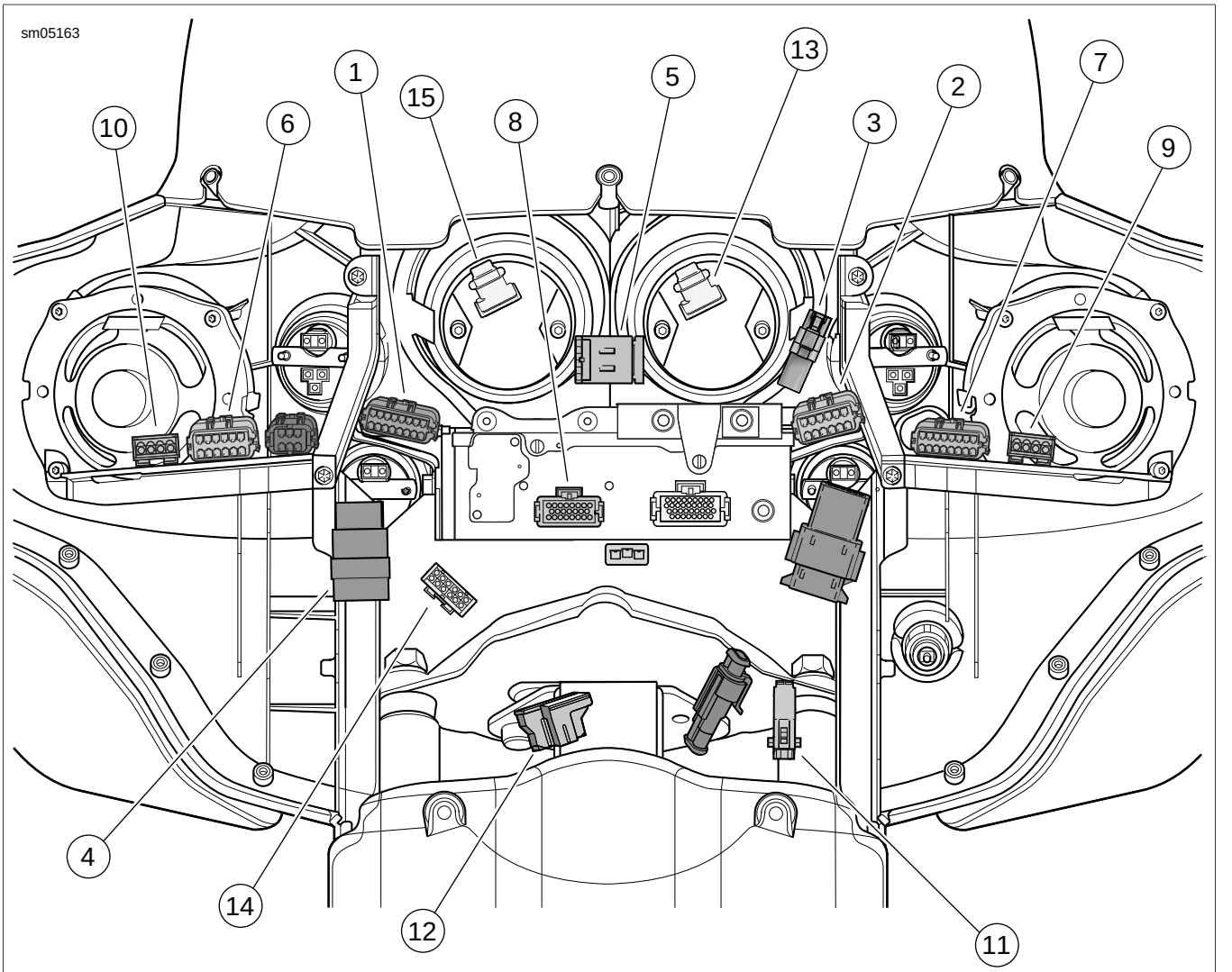


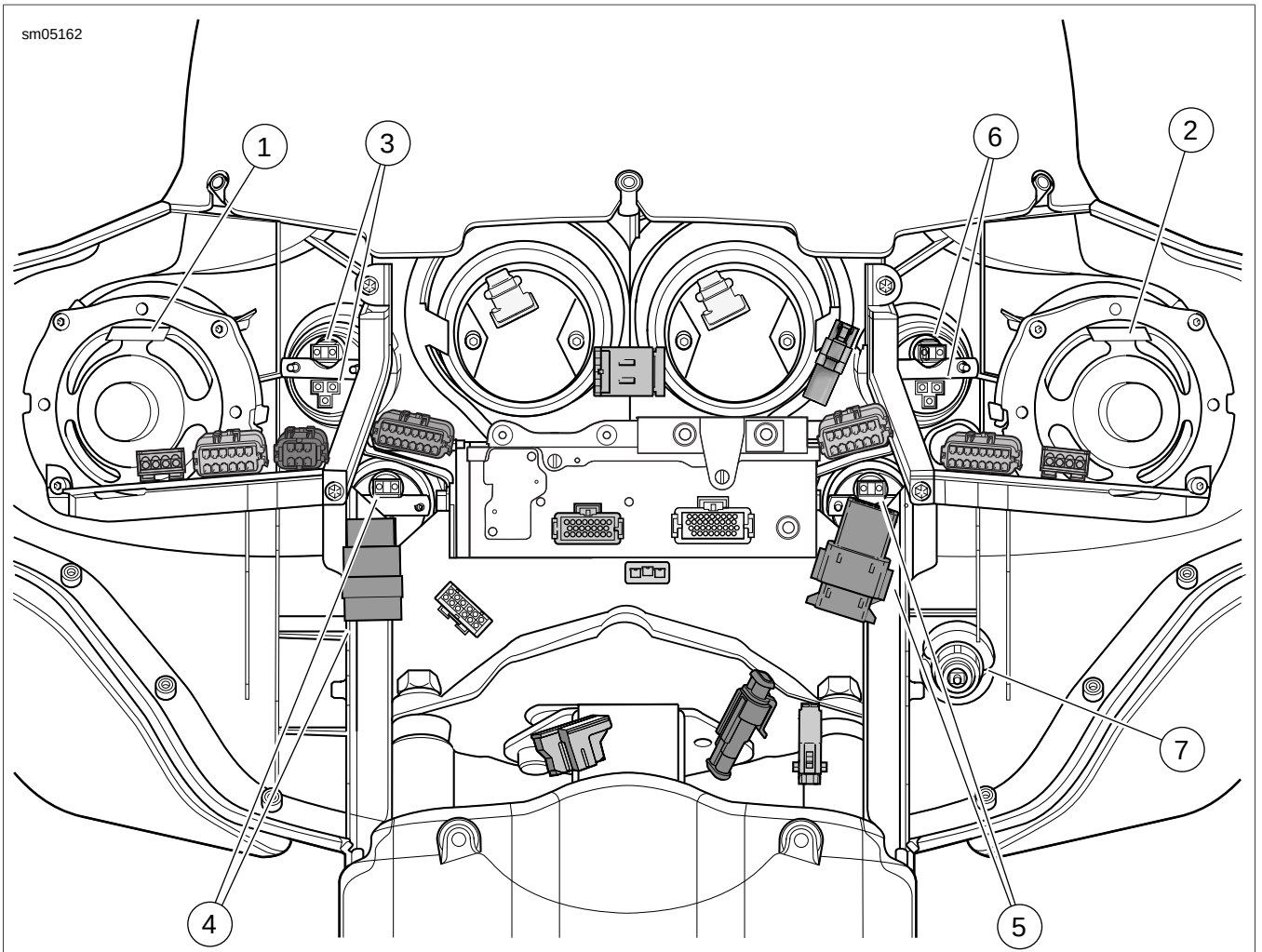
Figure 7-97. Anchor Interconnect Harness in Ear of Speedometer Bracket

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Main to interconnect harness [1]
2. Main to interconnect harness [2]
3. Audio to interconnect harness [6]
4. Main to interconnect harness [15]
5. Indicator lights [21]
6. Right handlebar switches [22]
7. Left handlebar switches [24]
8. Radio [27]
9. Left front turn signal/auxiliary lamp [31L]
10. Right front turn signal/auxiliary lamp [31R]
11. Front fender tip lamp [32]
12. Headlamp [38]
13. Speedometer gauge [39]
14. Fairing cap switches [105]
15. Tachometer gauge [108]

Figure 7-98. Inner Fairing- Interconnect Harness Connectors (FLHX, FLHT/C/U)



1. **Right front speaker [34]**
2. **Left front speaker [35]**
3. **Voltmeter gauge [111] and lamp [110]**
4. **Oil pressure gauge [113] and lamp [112]**
5. **Air temperature gauge [115] and lamp [114]**
6. **Fuel gauge [117] and lamp [116]**
7. **Cigarette lighter [132]**

Figure 7-99. Inner Fairing- Interconnect Harness Connectors (FLHX, FLHT/C/U)

Installation

NOTE

When referencing inner fairing locations, the term "fairing bracket" refers to either the left or right vertical support, while the term "support brace" refers to either the left or right horizontal support.

1. Center interconnect harness on top of radio (or storage box). To verify proper orientation, be sure that convoluted tubing of headlamp connector [38] is on left side of motorcycle, while conduit of fairing cap switch connector [105] is on the right.
2. From mid section of inner fairing (area between left and right fairing brackets), feed left side speaker, fuel gauge, air temperature gauge (if present), cigarette lighter, left front turn signal/auxiliary lamp [31L], and left handlebar switch [24] connectors and conduit behind left fairing bracket to area of left support brace.
3. From mid section of inner fairing (area between left and right fairing brackets), feed right side speaker, voltmeter gauge, oil pressure gauge (if present), right front turn signal/auxiliary lamp [31R], and right handlebar switch [22] connectors and conduit behind right fairing bracket to area of right support brace.
4. Install anchor on convoluted tubing of interconnect harness into lower ear of speedometer bracket.

5. See Figure 7-99. Install left side connectors onto spade contacts as follows:
 a. Air temperature gauge [115] and lamp [114], if present; identified by black tape.
 b. Fuel gauge [117] and lamp [116]; identified by orange tape.
 c. Left front speaker [35].
 d. Cigarette lighter [132]; connect the orange/white wire socket terminal to the socket spade contact, the black wire socket terminal to the shell contact.
6. Push harness ground socket terminal onto spade contact fastened to top of upper fork bracket (left side).
7. Install right side connectors onto spade contacts as follows:
 a. Oil pressure gauge [113] and lamp [112], if present; identified by black tape.
 b. Voltmeter gauge [111] and lamp [110]; identified by orange tape.
 c. Right front speaker [34].
8. See Figure 7-98. Connect connectors and install onto their retaining devices, if present.
 a. Left front turn signal/auxiliary lamp [31L], 4-place Multilock (black); T-stud on left fairing support brace (outboard side).
 b. Left handlebar switches [24], 16-place Molex (gray); T-stud on left fairing support brace (inboard side).
 c. Main to interconnect harness [2], 12-place Molex (gray); anchor in hole of left radio support bracket.
 d. Audio to interconnect harness [6], if present; 6-place Deutsch (black); left side of radio.
 e. Indicator lights [21]; 10-place Multilock (black); above radio (between speedometer and tachometer gauges).
 f. Speedometer [39]; 12-place Packard; back of speedometer. Unthread rubber boot from odometer reset switch and pull switch from hole in inner fairing.
 g. Tachometer [108]; 12-place Packard; back of tachometer.
 h. Main to interconnect harness [1], 16-place Molex (black); anchor in hole of right radio support bracket.
 i. Right handlebar switches [22], 12-place Molex (black); T-stud on right fairing support brace (middle).
 j. Right front turn signal/auxiliary lamp [31R], 4-place Multilocks (black); T-stud on right fairing support brace (outboard side).
 k. Main to interconnect harness [15], 4-place Packard (black); anchored in hole at front of right fairing bracket.
 l. Fairing cap switches [105], 12-place Multilock (black); top of upper fork bracket (right side).
 m. Radio [27], 23-place Amp (black); back of radio (right side).
 n. Front fender tip lamp jumper harness [32], if present; 2-place Multilock (black); below upper fork bracket (left side).
 o. Ambient temperature sensor [107], if present; 3-place Multilock (black); anchored in hole on left side of steering head.
9. See Figure 7-100. Install anchor on convoluted tubing of headlamp connector [38] into hole at front of left fairing bracket.
10. Using round hole at side of left fairing bracket, install **new** cable strap capturing convoluted tubing of headlamp connector [38] and conduit of main to interconnect harness connector [2] and left handlebar switch connector [24].
11. See Figure 7-101. Using oval shaped hole at side of right fairing bracket, install **new** cable strap capturing convoluted tubing of radio connector [27] and conduit of main to interconnect harness connector [1], main to interconnect harness connector [15] and right handlebar switch connector [22].
12. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

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13. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

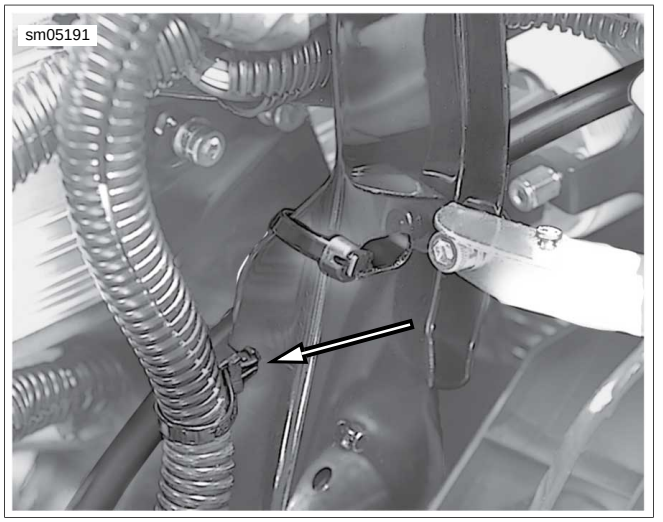


Figure 7-100. Anchor Convoluted Tubing of Headlamp Connector to Fairing Bracket (Left Side)

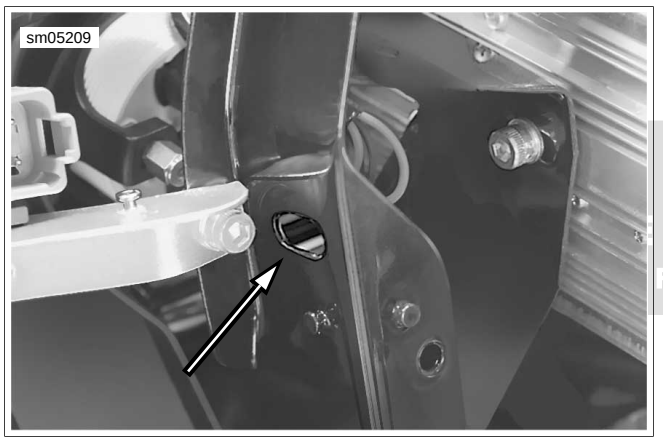


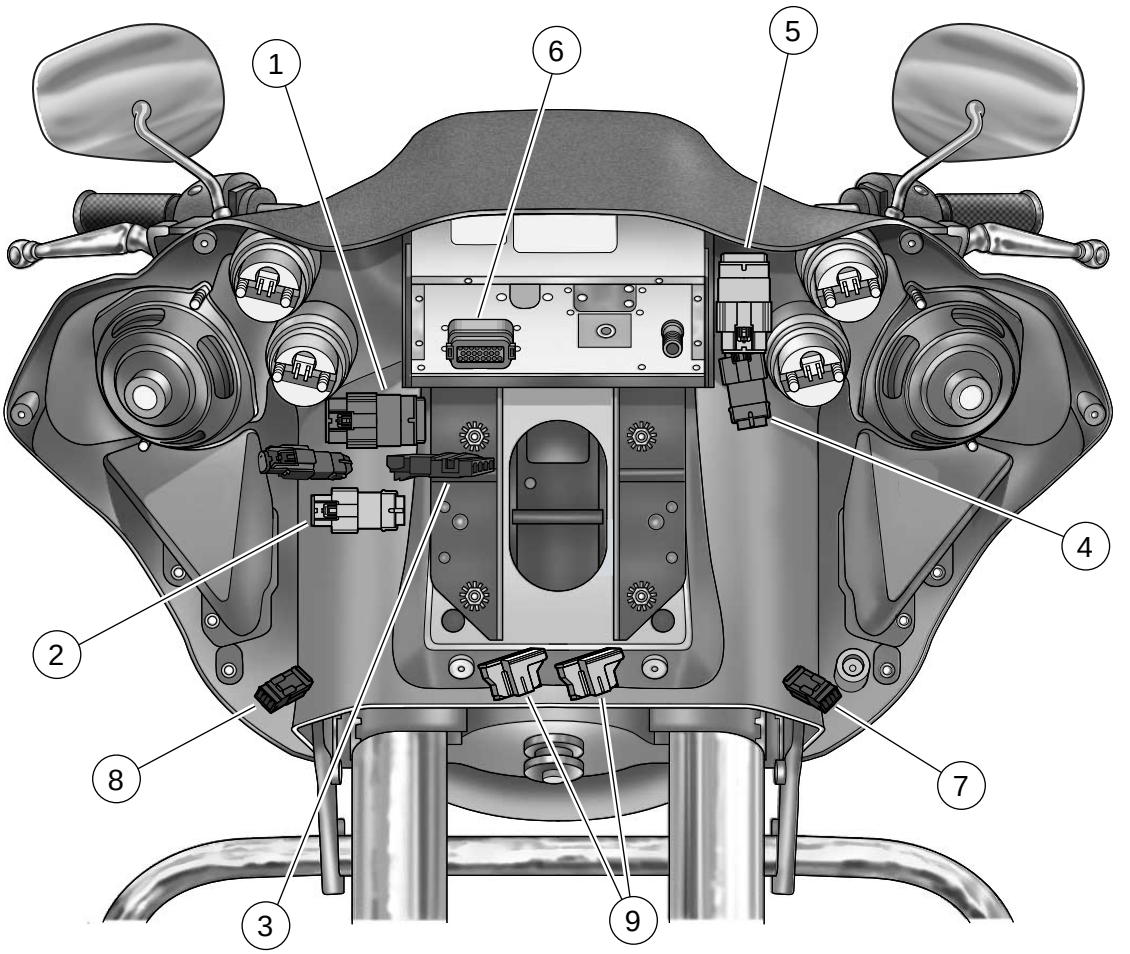
Figure 7-101. Cable Strap Conduit to Fairing Bracket (Right Side)

FLTR

Removal

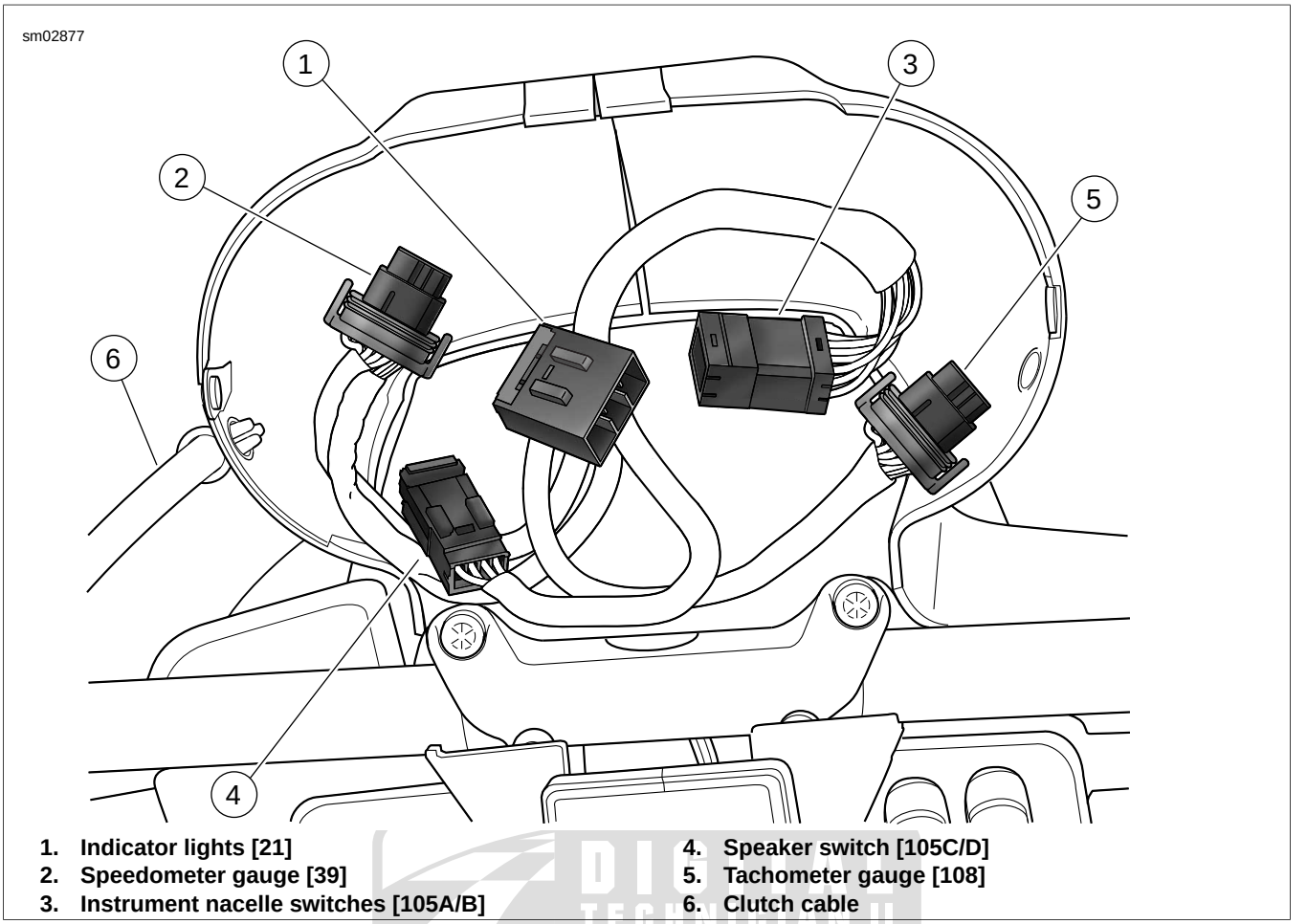
1. Remove main fuse. See 7.6 SYSTEM FUSES AND RELAYS.
2. Place protective material on top of front fender to protect paint from scratches or other damage.
3. Remove outer fairing. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
4. Carefully cut two cable straps to free wire bundles and conduit from convoluted tubing of interconnect harness and allow to hang naturally.
5. See Figure 7-102. Disconnect connectors and remove from their retaining devices, if present.
 a. Main to interconnect harness [1], 16-place Molex (black); below radio (right side).
 b. Main to interconnect harness [2], 12-place Molex (gray); below radio (right side).
 c. Main to interconnect harness [15], 4-place Packard (black); below radio (right side).
 d. Left handlebar switches [24], 16-place Molex (gray); T-stud on left side of radio bracket.
 e. Right handlebar switches [22], 12-place Molex (black); T-stud on left side of radio bracket.
 f. Radio [27], 23-place Amp (black); back of radio (right side).
6. Disconnect ambient temperature sensor connector [107], 3-place Multilock, from sensor anchored in hole on left side of steering head. Feed connector and conduit in through opening on left side of fairing bracket.
7. Proceed as follows:
 a. See Figure 7-103. Remove left side of instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.
 b. Disconnect Instrument nacelle switch connector [105], 12-place Multilock.
 c. Pull harness ground socket terminal from spade contact fastened to top of upper fork bracket (left side).
8. Draw branches of interconnect harness (terminating in odometer reset switch and speedometer, tachometer, indicator lights, instrument nacelle switches and ambient temperature sensor connectors) through tunnel of fairing bracket to front of inner fairing.
9. Remove left side connectors from spade contacts as follows:
 a. Cigarette lighter [132].
 b. Left speaker [35].
 c. Fuel gauge [117] and lamp [116].
 d. Air temperature gauge [115] and lamp [114].
10. Remove right side connectors from spade contacts as follows:
 a. Right speaker [34].
 b. Voltmeter gauge [111] and lamp [110].
 c. Oil pressure gauge [113] and lamp [112].
11. Free conduit of front turn signal lamp connectors [31L] and [31R], 3-place Multilocks, from flexible clips on sides of inner fairing.
12. Remove interconnect harness from motorcycle. Remove radio antenna cable connector [51] at back of radio (left side), if necessary.

sm05168



1. **Main to interconnect harness [1]**
2. **Main to interconnect harness [2]**
3. **Main to interconnect harness [15]**
4. **Right handlebar switches [22]**
5. **Left handlebar switches [24]**
6. **Radio [27]**
7. **Left turn signal [31L]**
8. **Right turn signal [31R]**
9. **Headlamp [38]**

Figure 7-102. Inner Fairing- Interconnect Harness Connectors (FLTR)



1. **Indicator lights [21]**
2. **Speedometer gauge [39]**
3. **Instrument nacelle switches [105A/B]**
4. **Speaker switch [105C/D]**
5. **Tachometer gauge [108]**
6. **Clutch cable**

Figure 7-103. Instrument Nacelle (Bezel Removed)

Installation

NOTE

To avoid chafing wires of interconnect harness, verify that trim strips are installed on hooks of radio bracket.

1. Center convoluted tubing of interconnect harness above and inboard of hooks on radio bracket. To verify proper orientation, be sure that long length of conduit terminating in socket terminals of cigarette lighter is on left side of motorcycle. Install radio antenna cable connector [51] at back of radio (left side), if removed.
2. Install left side connectors onto spade contacts as follows:
 a. Cigarette lighter [132]; connect the orange/white wire socket terminal to the socket spade contact, the black wire socket terminal to the shell contact.
 b. Left speaker [35].
 c. Fuel gauge [117] and lamp [116].
 d. Air temperature gauge [115] and lamp [114].
3. Install right side connectors onto spade contacts as follows:
 a. Right speaker [34].
 b. Voltmeter gauge [111] and lamp [110].
 c. Oil pressure gauge [113] and lamp [112].
4. Find branch of interconnect harness terminating in odometer reset switch and speedometer, tachometer, indicator lights and instrument nacelle switch connectors. Feed connectors and conduit from front of inner fairing through tunnel of fairing bracket and then out through opening at top of fairing bracket to instrument nacelle.
5. Proceed as follows:
 a. Push harness ground socket terminal onto spade contact fastened to top of upper fork bracket (left side).
 b. See Figure 7-103. Connect Instrument nacelle switch connector [105], 12-place Multilock.
 c. Install left side of instrument nacelle. See 2.43 INSTRUMENT NACELLE: FLTR.

6. See Figure 7-102. Connect connectors and install onto their retaining devices, if present.
 a. Main to interconnect harness [1], 16-place Molex (black); below radio (right side).
 b. Main to interconnect harness [2], 12-place Molex (gray); below radio (right side).
 c. Main to interconnect harness [15], 4-place Packard (black); below radio (right side).
 d. Left handlebar switches [24], 16-place Molex (gray); T-stud on left side of radio bracket.
 e. Right handlebar switches [22], 12-place Molex (black); T-stud on left side of radio bracket.
 f. Radio [27], 23-place Amp (black); back of radio (right side).
7. Orient connectors as shown in Figure 7-102. Install two **new** cable straps outboard of radio bracket hooks to secure wire bundles and conduit to convoluted tubing of interconnect harness. Cut any excess cable strap material. See Figure 7-104.
8. Capture conduit of front turn signal lamp connectors [31L] and [31R], 3-place Multilocks, in flexible clips on sides of inner fairing.
9. Install outer fairing. See 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
10. Install main fuse. See 7.6 SYSTEM FUSES AND RELAYS.

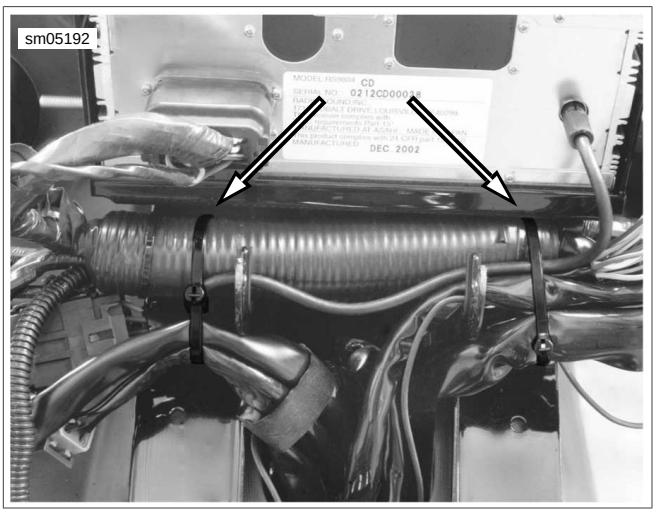


Figure 7-104. Cable Strap Convoluted Tubing and Conduit

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

RADIO ANTENNA CABLE 7.37

FLHTC/U

Removal

1. Remove fuel tank and seat. See 4.5 FUEL TANK.
2. Remove left side saddlebag. See 2.29 SADDLEBAGS.
3. Remove left side cover.
4. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
5. See Figure 7-105. Remove radio antenna cable connector [51] at back of radio (left side). Cut cable where it exits main harness conduit.
6. Remove rivet and P-clamp to release main harness from left side of steering head.
7. Starting at front of wire trough, remove cover.
8. Cut two cable straps securing main harness conduit to left upper frame tube. Cut cable strap securing main harness conduit to luggage rack rail.
9. Open Tour-Pak and remove rubber mat (FLHTC) or map pocket and molded liner (FLHTCU).
10. **FLHTCU models:** Remove bulb socket from left side wrap-around light.
11. Disconnect radio antenna cable connector [29]. Release cable from two adhesive clips at bottom of Tour-Pak.
12. See Figure 7-106. Disconnect Tour-Pak lights connector [12], 3-place Multilock.
13. Pull grommet into Tour-Pak and remove from harness.
14. See Figure 7-107. Pull Tour-Pak lights and radio antenna cable connectors out through hole at front of Tour-Pak.
15. Carefully cut radio antenna cable where it exits main harness conduit.

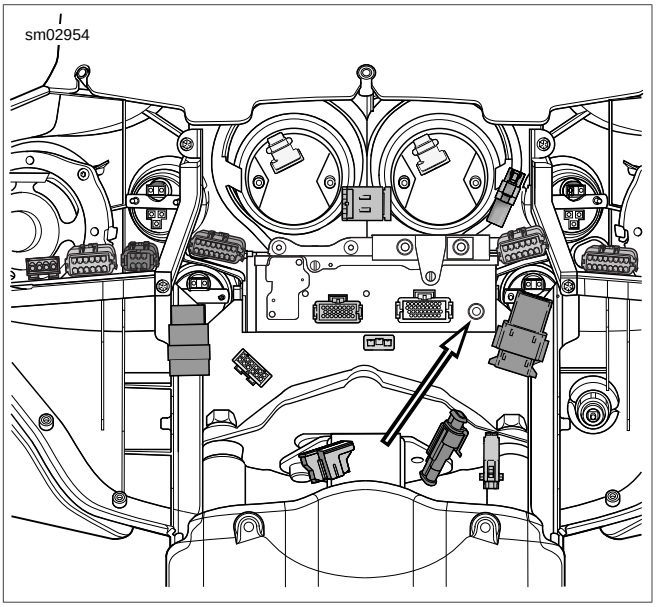
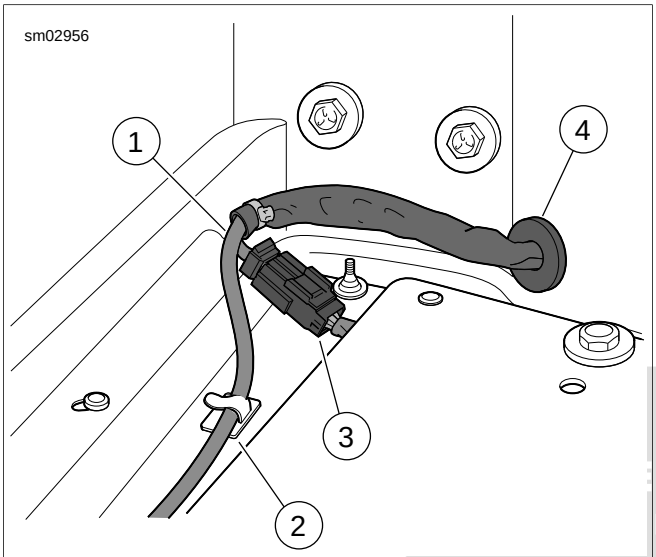


Figure 7-105. Radio Antenna Cable Connector (FLHX, FLHTC/U)

Installation

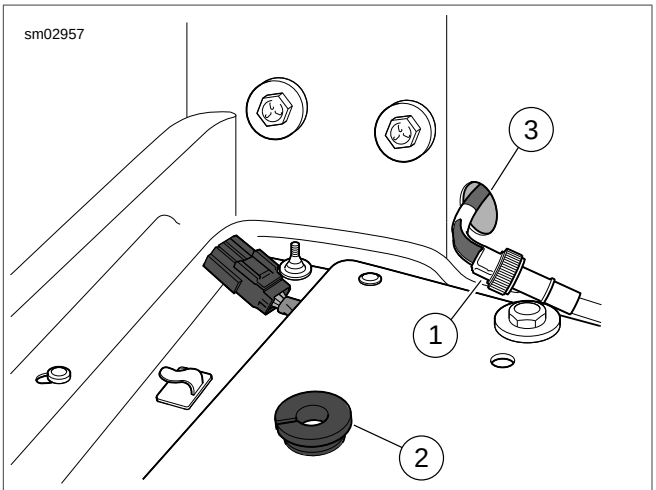
1. See Figure 7-105. Connect radio antenna cable connector [51] at back of radio (left side).
2. Route free end of **new** radio antenna cable rearward along left side of steering head.
3. Capture radio antenna cable and main harness conduit in P-clamp. Secure P-clamp to steering head with rivet.
4. Route radio antenna cable rearward through left side of wire trough, then along inboard side of left upper frame tube. Continue rearward following luggage rack rail to front of Tour-Pak.
5. Loosely install two **new** cable straps to secure radio antenna cable and main harness to left upper frame tube. On FLHTCU models, also capture audio harness conduit at this location.
6. Loosely install **new** cable strap to secure radio antenna cable and main harness conduit to luggage rack rail.
7. Feed Tour-Pak lights and radio antenna cable connectors through hole at front of Tour-Pak. Capture cable and conduit in grommet and install grommet with the larger OD inside.
8. See Figure 7-106. Connect Tour-Pak lights connector [12], 3-place Multilock.
9. Connect radio antenna cable connector [29]. Capture cable in two adhesive clips at bottom of Tour-Pak.
10. **FLHTCU models:** Install bulb socket of left side wrap-around light.

11. Tighten three cable straps securing radio antenna cable and main harness to left upper frame tube and luggage rack rail. Cut excess cable strap material.
12. Install rubber mat (FLHTC) or molded liner and map pocket (FLHTCU) in Tour-Pak.
13. Install cover over wire trough. Verify that all latches are fully engaged.
14. Install fuel tank and seat. See 4.5 FUEL TANK.
15. Install left side cover.
16. Install left side saddlebag. See 2.29 SADDLEBAGS.
17. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.



1. **Radio antenna cable**
2. **Adhesive clip**
3. **Tour-pak lights connector [12]**
4. **Grommet**

Figure 7-106. Disconnect Tour-Pak Lights Connector



1. **Radio antenna cable connector [29]**
2. **Grommet**
3. **Tour-pak hole**

Figure 7-107. Feed Main Harness Through Tour-Pak Hole

FLHX, FLTR

Removal

1. Remove seat and fuel tank. See 4.5 FUEL TANK.
2. Remove left side saddlebag. See 2.29 SADDLEBAGS.
3. Remove left side cover.
4. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.
5. See Figure 7-108. Remove radio antenna cable connector [51] at back of radio (left side). Cut antenna cable where it exits main harness conduit.
6. Remove rivet and P-clamp to release main harness conduit from left side of steering head.
7. Starting at front of wire trough, remove cover.
8. See Figure 7-109. Cut cable straps to release radio antenna cable from air valve mounting bracket and saddlebag support.
9. Disconnect radio antenna cable connector from antenna.
10. Cut radio antenna cable where it exits main harness conduit.

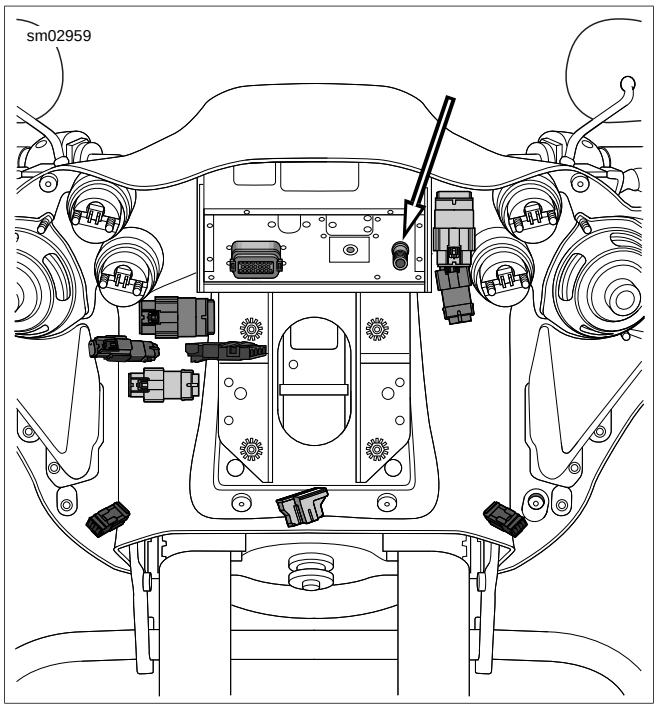
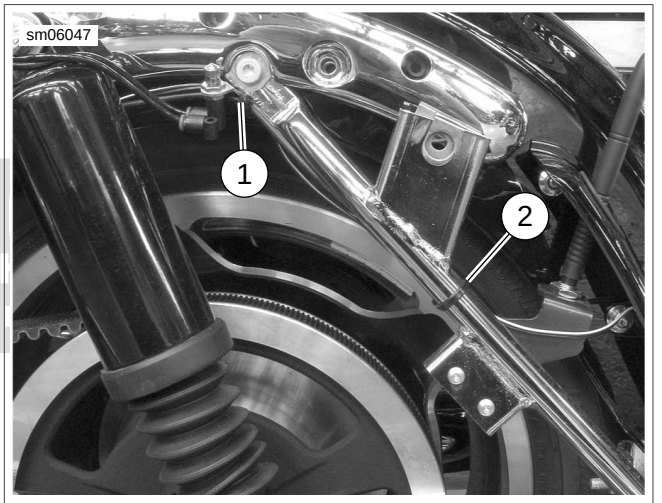


Figure 7-108. Radio Antenna Cable Connector (FLTR)

Installation

1. See Figure 7-108. Connect radio antenna cable connector [51] at back of radio (left side).
2. Proceed as follows:
 a. **FLHX:** Route free end of radio antenna cable rearward along left side of steering head.
 b. **FLTR:** Route free end of radio antenna cable into tunnel of fairing bracket pulling it out through opening on left side of bracket and then continuing rearward along steering head.
3. Capture radio antenna cable and main harness in P-clamp and secure to steering head with rivet.
4. Route radio antenna cable rearward through left side of wire trough, then along inboard side of left upper frame tube to area of antenna.
5. See Figure 7-109. Loosely install **new** cable straps to secure radio antenna cable (and rear fascia lamp wires on FLHX) to air fitting bracket (1) and saddlebag support (3).
6. Connect radio antenna cable to bottom of antenna.
7. Tighten cable straps securing radio antenna cable and cut excess cable strap material.
8. Install cover over wire trough. Verify that all latches are fully engaged.
9. Install fuel tank and seat. See 4.5 FUEL TANK.
10. Install left side cover.
11. Install left side saddlebag. See 2.29 SADDLEBAGS.
12. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.41 UPPER FAIRING AND WINDSHIELD: FLTR.



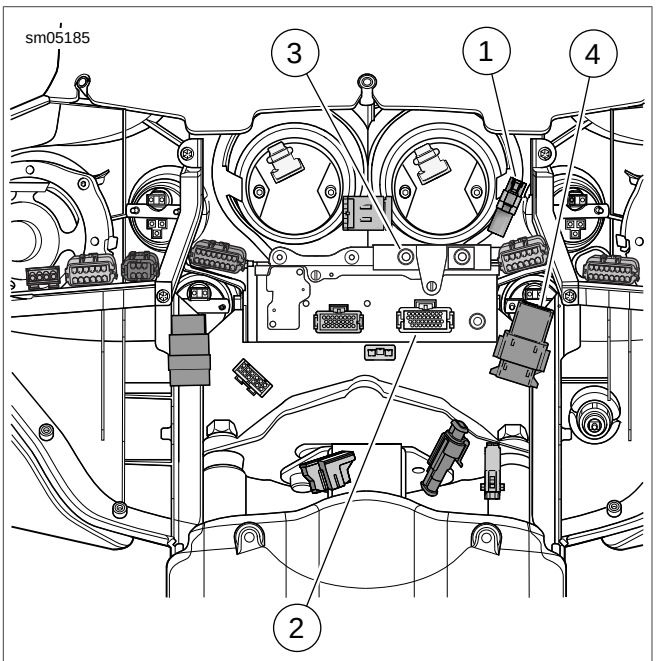
1. Air valve bracket
2. Saddlebag support

Figure 7-109. Radio Antenna Cable Routing (FLHX shown)

AUDIO HARNESS: FLHTCU 7.38

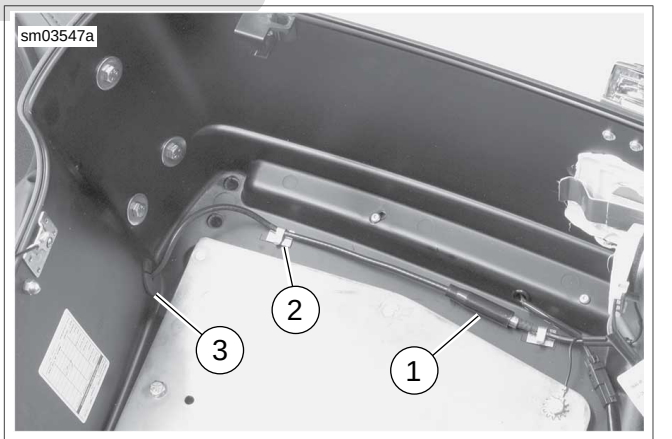
REMOVAL

1. Remove fuel tank. See 4.5 FUEL TANK.
2. Remove saddlebags. See 2.29 SADDLEBAGS.
3. Remove both side cover.
4. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
5. See Figure 7-110. Disconnect the following connectors:
 a. CB antenna cable (3).
 b. Audio to interconnect harness (1).
 c. Radio (2).
 d. CB module (4).
6. Remove rivet and P-clamp securing audio and main harness to left side of steering head.
7. Pull audio harness rearward and out of fairing cap.
8. Remove map pocket and molded liner from Tour-Pak.
9. See Figure 7-111. Disconnect CB antenna cable connector (1). Release cable from adhesive clip (2).
10. Pull grommet (3) into Tour-Pak and remove from CB antenna cable. Pull CB antenna cable out through hole.
11. Draw rear speaker/passenger controls connector out of right side speaker box and disconnect. Repeat with left speaker harness.
12. Cut cable straps securing audio harnesses and CB antenna cable to luggage rack rails.
13. Release rear headset receptacle from bracket at bottom of left side speaker box and disengage spring.
14. Release console connector [53], 12-place Deutsch, from attachment clip anchored in hole of frame weldment at rear of battery tray. Disconnect connector.
15. Cut four cable straps securing audio harness to left and right upper frame tubes.
16. Remove cover from wire trough.
17. Using a paint pen, draw a line on the audio harness conduit where it enters and exits the wire trough.
18. Draw a line on both sides of each cable strap that captures the audio harness. Carry the line over onto the main harness where possible.
19. Cut and remove cables straps to free audio harness.
20. Remove audio harness from motorcycle.



1. **Audio to interconnect harness [6]**
2. **Radio [28]**
3. **CB antenna cable [50]**
4. **CB module [184]**

Figure 7-110. Audio Harness Connectors (FLHTCU)



1. **CB antenna cable connector [104]**
2. **Adhesive clip**
3. **Grommet**

Figure 7-111. CB Antenna Cable Connector [104]

INSTALLATION

1. Lay **new** and used audio harnesses side by side. Transfer painted lines onto new harness.
2. Install **new** cable straps through slots of wire trough where removed.

NOTE

If additional clearance is needed for installation of the cable straps, pry up rear of wire trough to release anchor pins from holes in frame backbone. Reinstall wire trough after placement of cable straps.

3. Adjust main harness as necessary, so that the painted lines are aligned with the cable straps installed in the wire trough.
4. Place audio harness on top of main harness aligning the entrance and exit lines with the wire trough. Verify that branch containing rear headset receptacle exits left side of wire trough and branch containing CB antenna cable connector exits right side.
5. Engage end of each cable strap into eyelet, but do not tighten.
6. Route front section of audio harness along left side of steering head and up toward radio.
7. Install connectors in radio and CB module.
8. Secure audio and main harness to left side of steering head using P-clamp and **new** rivet.
9. Route right harness branch along inboard side of right upper frame tube and up the luggage rack rail to speaker. Route CB antenna cable through hole in Tour-Pak.
10. Loosely install **new** cable straps to secure audio harness to right upper frame tube and luggage rack rail.
11. Install grommet in Tour-Pak with the larger OD facing inside.
12. Connect CB antenna cable connector and capture cable in adhesive clip at bottom of Tour-Pak.
13. Connect right speaker/passenger controls connector. Feed connector into speaker box pressing trim ring into hole.
14. Tighten cable straps securing right-side harness to frame and luggage rack. Remove excess strap material.
15. Connect console connector [53], 12-place Deutsch. Install connector onto attachment clip anchored in hole of frame weldment at rear of battery tray.
16. Route left harness branch along inboard side of left upper frame tube, up luggage rack rail to speaker.
17. Connect left speaker/passenger controls connector. Feed connector into speaker box pressing trim ring into hole.
18. Connect spring loop of rear headset receptacle onto tab on right side of license plate bracket. Capture headset receptacle in bracket.
19. Loosely install **new** cable straps to secure audio harness to left upper frame tube and luggage rack rail.
20. Install molded liner and map pocket in Tour-Pak.
21. Make final adjustments to harness, so that painted lines are aligned with cable straps. Tighten all cable straps and cut excess strap material.
22. Install cover on wire trough. Verify that all latches are fully engaged.
23. Install fuel tank. See 4.5 FUEL TANK.
24. Install side covers and saddlebags, right side first. See 2.29 SADDLEBAGS.
25. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

DIGITAL TECHNICIAN HARLEY-DAVIDSON

CB ANTENNA CABLE: FLHTCU 7.39

REMOVAL

1. Remove fuel tank. See 4.5 FUEL TANK.
2. Remove right side saddlebag. See 2.29 SADDLEBAGS.
3. Remove right side cover.
4. Remove outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
5. See Figure 7-112. Disconnect CB antenna cable connector from CB module. Carefully cut cable where it exits audio harness conduit.
6. Remove cover from wire trough.
7. Carefully cut two cable straps securing audio harness to right upper frame tube and one securing audio harness to luggage rack rail.
8. Remove map pocket and molded liner from Tour-Pak.
9. See Figure 7-113. Disconnect CB antenna cable connector (1). Release cable from front adhesive clip (2).
10. Pull grommet (3) into Tour-Pak and remove from CB antenna cable. Pull CB antenna cable out through hole at front of Tour-Pak.
11. Cut CB antenna cable where it exits audio harness conduit.

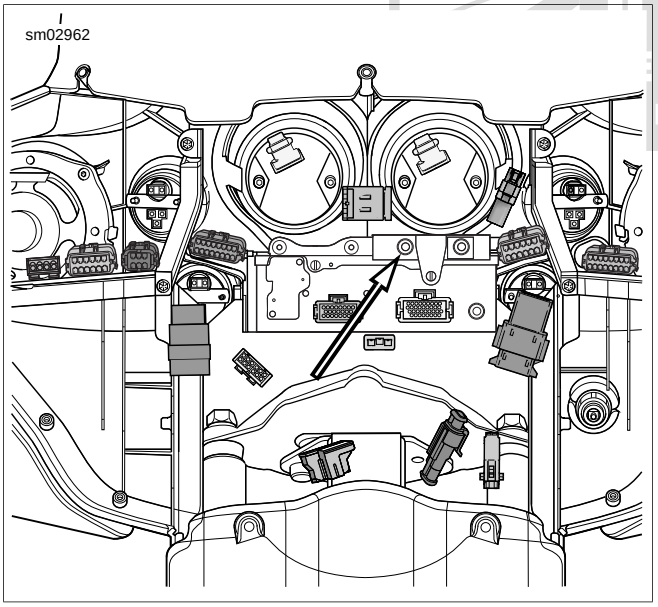
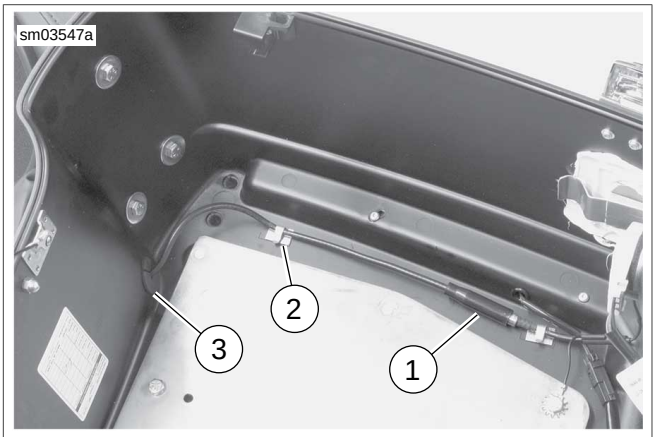


Figure 7-112. CB Antenna Cable Connector [50]



1. **CB antenna cable connector [104]**
2. **Adhesive clip**
3. **Grommet**

Figure 7-113. CB Antenna Cable Connector [104]

INSTALLATION

1. Connect CB antenna cable connector to CB module.
2. Route free end of CB antenna cable rearward along left side of steering head and through wire trough. Exit wire trough at rear right side and route cable along inboard side of right upper frame tube, following luggage rack rail and into front of Tour-Pak.
3. Remove rivet and P-clamp to release audio and main harness conduit from left side of steering head. Capture CB antenna cable in P-clamp and install.
4. Loosely install two **new** cable straps to secure CB antenna cable and audio harness to right upper frame tube.
5. See Figure 7-114. Loosely install **new** cable strap to secure CB antenna cable and audio harness conduit to luggage rack rail. Loosely install **new** cable strap to secure CB antenna cable to speaker/passenger controls conduit.
6. Install grommet in Tour-Pak with the larger OD facing inside.
7. Connect CB antenna cable connector. Capture cable in front adhesive clip at bottom of Tour-Pak.
8. Tighten all cable straps securing CB antenna cable. Remove excess cable strap material.
9. Install molded liner and map pocket in Tour-Pak.
10. Install cover on wire trough. Verify that all latches are fully engaged.
11. Install fuel tank. See 4.5 FUEL TANK.
12. Install right side cover.
13. Install right side saddlebag. See 2.29 SADDLEBAGS.
14. Install outer fairing. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

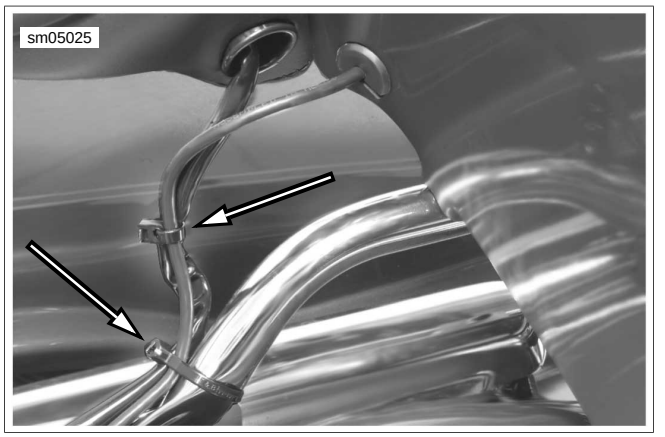


Figure 7-114. Capture Audio Harness and CB Antenna Cable

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

HANDLEBAR SWITCH ASSEMBLIES 7.40

REMOVAL

NOTE

While there are four different switch configurations for Touring models (Road King, Road King Classic, Classic and Ultra), the removal procedures are the same. To simplify these instructions, only the Road King switch configuration is represented in the photographs and illustrations which follow.

Right Handlebar Controls

CAUTION

Do not remove or install the master cylinder assembly without first positioning a 5/32-inch (4 mm) thick insert between the brake lever and lever bracket. Removing or installing the master cylinder assembly without the insert in place may result in damage to the rubber boot and plunger on the front stoplight switch. (00324a)

NOTE

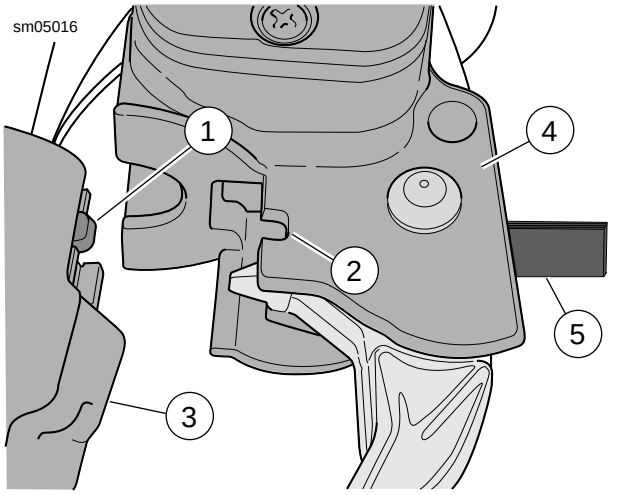
Use the eyelet of a cable strap if the cardboard insert is not available.

1. See Figure 7-115. Place cardboard insert between brake lever and lever bracket.
2. Remove two screws (with flat washers) securing handlebar clamp to master cylinder housing. Remove brake lever/master cylinder assembly and clamp from handlebar.
3. Remove upper and lower switch housing screws.
4. Remove friction shoe from end of tension adjuster screw (non cruise equipped models only).

NOTE

The friction shoe is a loose fit and may fall out or become dislodged if lower switch housing is turned upside down or shaken.

5. Cut two cable straps to release wire harness conduit from handlebar, if present.



1. **Tab**
2. **Groove**
3. **Switch housing assembly**
4. **Brake lever bracket**
5. **Cardboard insert**

Figure 7-115. Remove Master Cylinder/Brake Lever Assembly

Left Handlebar Controls

1. Remove two screws (with flat washers) securing handlebar clamp to clutch lever bracket. Remove clutch hand lever assembly and clamp from handlebar.
2. Remove upper and lower switch housing screws.
3. Cut two cable straps to release wire harness conduit from handlebar, if present.
4. Remove hand grip from handlebar, if damaged. See 2.26 HANDLEBARS, Left Hand Grip.

DISASSEMBLY

Right Side Handlebar Switches

CAUTION

Do not remove or install the master cylinder assembly without first positioning a 5/32-inch (4 mm) thick insert between the brake lever and lever bracket. Removing or installing the master cylinder assembly without the insert in place may result in damage to the rubber boot and plunger on the front stoplight switch. (00324a)

NOTE

Use the eyelet of a cable strap if the cardboard insert is not available.

1. Place cardboard insert between brake lever and lever bracket.
2. Remove upper and lower switch housing screws.

3. If replacing lower housing switches, proceed to next step. If replacing upper housing switches, proceed to 7.40 HANDLEBAR SWITCH ASSEMBLIES, Specific Repair Procedures: Upper Switch Housings.
4. Loosen upper screw securing handlebar clamp to master cylinder housing. Remove lower clamp screw (with flat washer).
5. Remove friction shoe from end of tension adjuster screw (non cruise equipped models only).

NOTE

The friction shoe is a loose fit and may fall out or become dislodged if lower switch housing is turned upside down or shaken.

Left Side Handlebar Switches

1. Remove upper and lower switch housing screws.
2. If replacing lower housing switches, proceed to next step. If replacing upper housing switches, proceed to 7.40 HANDLEBAR SWITCH ASSEMBLIES, Specific Repair Procedures: Upper Switch Housings.
3. Loosen upper screw securing handlebar clamp to clutch lever bracket. Remove lower clamp screw (with flat washer).

SPECIFIC REPAIR PROCEDURES: UPPER SWITCH HOUSINGS

NOTES

- *Regardless of model or option, all motorcycles use the same upper switch housings.*
- *Replace Engine Stop and Engine Start Switches as a single assembly even if only one switch is determined to be faulty.*

Right Side Handlebar (All Models)

1. See Figure 7-116. From inside switch housing, remove screw to release bracket. Remove bracket and switch assembly from housing.
2. Move cable conduit from beneath wing of bracket. Cut wires 0.25 in. (6.4 mm) from old switches. Discard old switch and bracket assembly.
3. Slide conduit forward over severed ends of switch wires and cut off 0.5 in. (12.7 mm) of conduit material. Push conduit back to access switch wires.
4. Separate **new** Engine Stop Switch and Start Switch wires into two bundles.

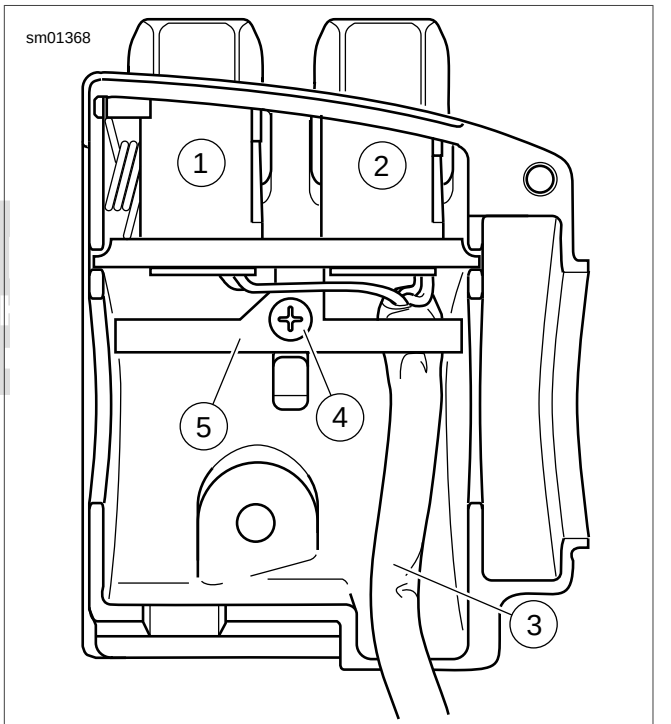
NOTE

Replacement Stop Switch and Start Switch wires are cut to length, 2.5 in. (63.5 mm) and 2.0 in. (50.8 mm), respectively, and partially stripped.

5. Splice wires together. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
6. Loop switch wires so that spliced lengths are positioned as shown in Figure 7-117. Route wires downstream of splices beneath wing on Engine Stop Switch side of bracket as shown in Figure 7-116.
7. Install **new**7.0 in. (178 mm) cable strap beneath wing on Engine Start Switch side of bracket and capture wire splices.
8. Place switch assembly into upper housing aligning hole in bracket with threaded hole in boss. Be sure that bracket is fully seated. The step at edge of boss captures bottom edge of bracket, while tabs on each side of bracket fit in slots cast into housing.
9. See Figure 7-116. Install screw to secure bracket inside housing. Verify that wing on Engine Stop Switch side of bracket captures edge of conduit.
10. Securely tighten cable strap to draw splices to bracket. Remove any excess cable strap material.
11. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Right Side Handlebar Switches.

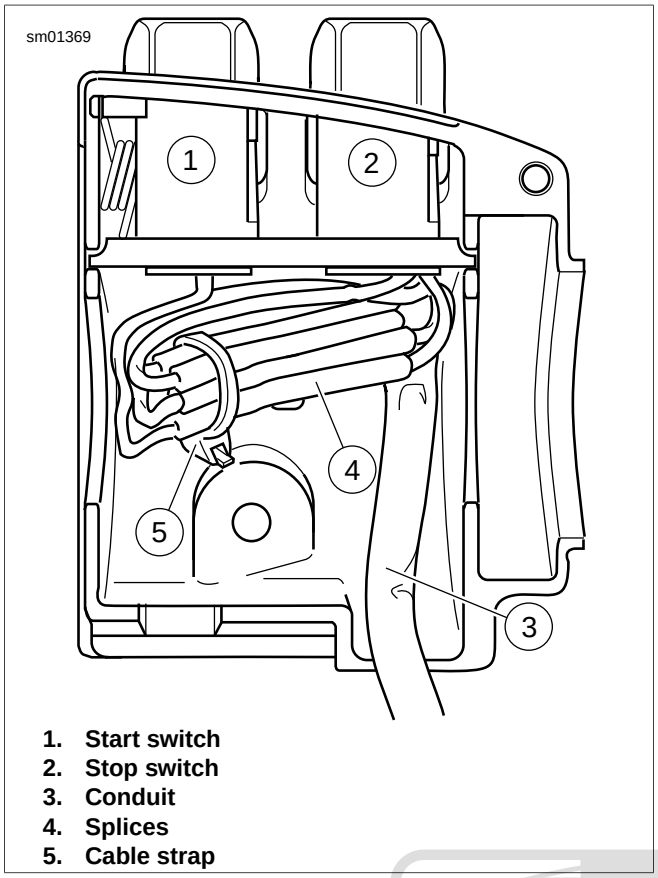
NOTE

Replace Horn and High/Low Beam Switches as a single assembly even if only one switch is determined to be faulty.



1. **Start switch**
2. **Stop switch**
3. **Conduit**
4. **Screw with lock washer**
5. **Bracket**

Figure 7-116. Upper Right Handlebar Switch Housing (Without Splices)



1. **Start switch**
2. **Stop switch**
3. **Conduit**
4. **Splices**
5. **Cable strap**

Figure 7-117. Upper Right Handlebar Switch Housing (With Splices)

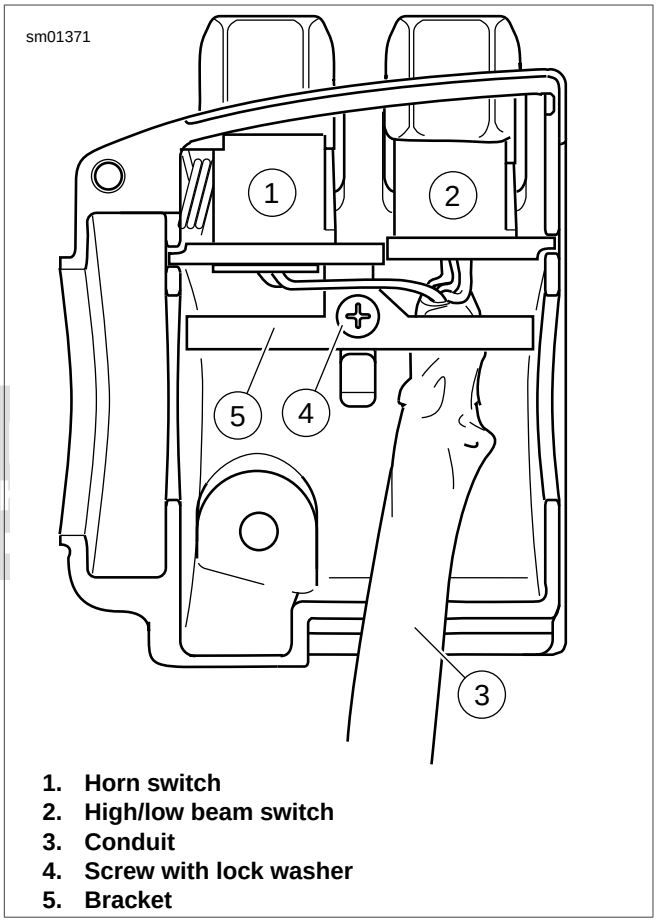
Left Side Handlebar (All Models)

1. See Figure 7-118. From inside switch housing, remove screw to release bracket. Remove bracket and switch assembly from housing.
2. Move cable conduit from beneath wing of bracket. Cut wires 0.25 in. (6.4 mm) from old switches. Discard old switch and bracket assembly.
3. Slide conduit forward over severed ends of switch wires and cut off 0.5 in. (12.7 mm) of conduit material. Push conduit back to access switch wires.
4. Separate **new** Horn and High/Low Beam Switch wires into two bundles.

NOTE

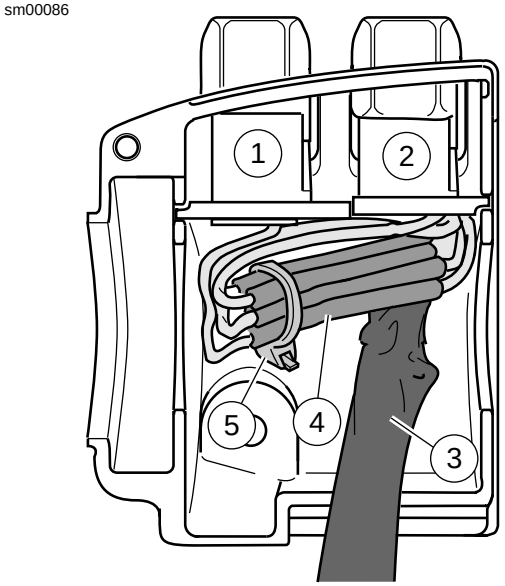
Replacement High/Low Beam Switch and Horn Switch wires are cut to length, 2.5 in. (63.5 mm) and 2.0 in. (50.8 mm), respectively, and partially stripped.

5. Splice wires together. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
6. Loop switch wires so that spliced lengths are positioned as shown in Figure 7-119. Route wires downstream of splices beneath wing on High/Low Beam Switch side of bracket as shown in Figure 7-118.
7. Install **new**7.0 in. (178 mm) cable strap beneath wing on Horn Switch side of bracket and capture wire splices.
8. Place switch assembly into upper housing aligning hole in bracket with threaded hole in boss. Be sure that bracket is fully seated. The step at edge of boss captures bottom edge of bracket, while tabs on each side of bracket fit in slots cast into housing.
9. See Figure 7-118. Install screw to secure bracket inside housing. Verify that wing on High/Low Beam Switch side of bracket captures edge of conduit.
10. See Figure 7-119. Securely tighten cable strap to draw splices to bracket. Remove any excess cable strap material.
11. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Left Side Handlebar Switches.



1. **Horn switch**
2. **High/low beam switch**
3. **Conduit**
4. **Screw with lock washer**
5. **Bracket**

Figure 7-118. Upper Left Handlebar Switch Housing (Without Splices)



1. **Horn switch**
2. **High/low beam switch**
3. **Conduit**
4. **Splices**
5. **Cable strap**

Figure 7-119. Upper Left Handlebar Switch Housing (With Splices)

SPECIFIC REPAIR PROCEDURES: RIGHT SIDE LOWER SWITCH HOUSINGS

Preliminary Instructions

1. From inside switch housing, carefully cut cable strap to free conduit from turn signal switch bracket, if present.
2. Remove screw to release turn signal switch bracket. Remove bracket and switch assembly from housing.

NOTE

On Classic and Ultra models, pull conduit back to introduce some slack in wires or the tight fit of the bundle will prevent removal of turn signal switch bracket.

Turn-Right Signal Switch (All Models)

1. Cut wires 1.5 in. (38.1 mm) from old switch. Discard old switch assembly.

NOTE

Replacement Turn-Right Signal Switch wires are cut to length, 1.5 in. (38.1 mm), and partially stripped.

2. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.

Front Stoplight Switch (All Models)

1. Carefully remove wedge between switch and switch housing, if present. To remove switch from housing, press plunger and slowly rotate switch upward while rocking slightly.
2. Cut wires 1.0 in. (25.4 mm) from old switch. Discard old switch.

NOTE

Replacement Stoplight Switch wires are cut to length, 2.5 in. (63.5 mm), and partially stripped.

3. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
4. Carefully press plunger against inside wall of switch housing. With thumb over plunger bore, move switch into installed position in switch housing cavity. When plunger is positioned against thumb, slowly rotate switch downward while rocking slightly. Release plunger only after switch is properly positioned in cavity.
5. Verify that plunger is square in bore and that boot is not compressed, collapsed or torn. If necessary, gently work plunger in and out until boot is fully extended.
6. See Figure 7-120. Push down on switch, so that it bottoms against housing and wires run in groove at base of cavity. With concave side facing outward, insert wedge between switch and outboard side of switch housing.
7. Push wedge down until it also bottoms against housing. Verify that plunger is still square in bore and then place a drop of RTV Silicone Sealant on upper corner of wedge.

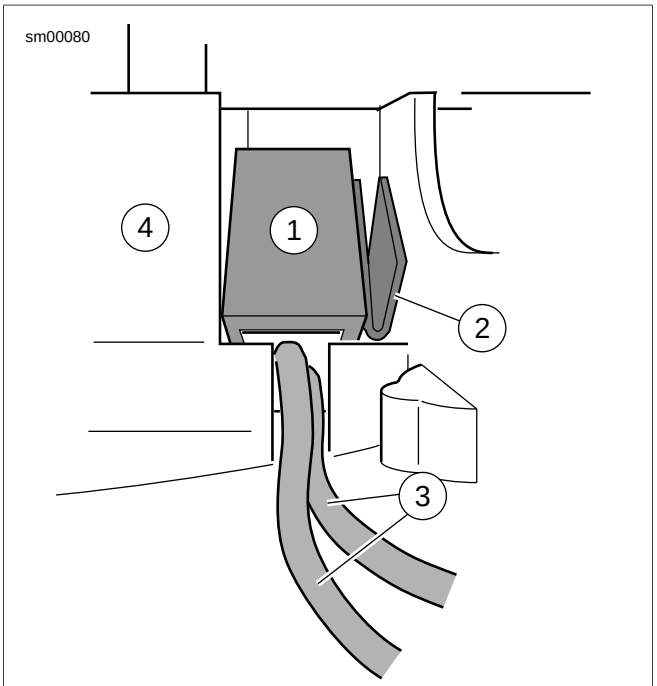
Mode Select Switch (Classic and Ultra Models)

1. Pull keycap from switch shaft.
2. See Figure 7-121. Remove two lower bracket screws. Pull bracket and switch from switch housing.
3. Cut wires 1.25 in. (31.8 mm) from old switch. Discard switch assembly.

NOTE

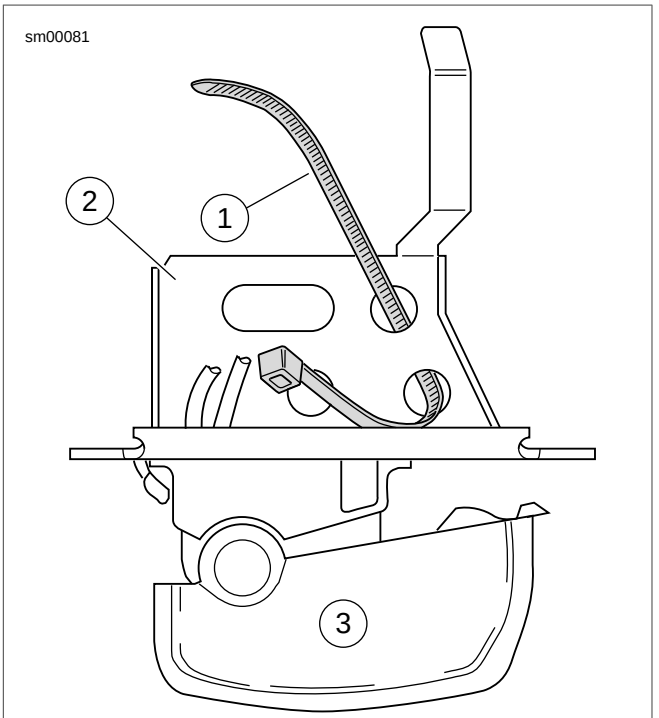
Replacement Mode Select Switch wires are cut to length, 2.25 in. (57.2 mm), and partially stripped.

4. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
5. Fit **new** switch into cavity, so that it sits on edge in a vertical position (gray/white wire topside). Properly installed, switch is captured by blocks cast into lower housing. Verify that switch shaft is aligned for proper keycap operation.
6. Place lower bracket into housing (with weld nut side down), but keep splices above bracket. Verify that slots in upper step of bracket engage two tabs on switch body.
7. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. To engage threaded hole in casting, use thru hole in lower step of bracket on Classic models, thru hole in upper step on Ultra.
8. Install keycap on switch shaft.



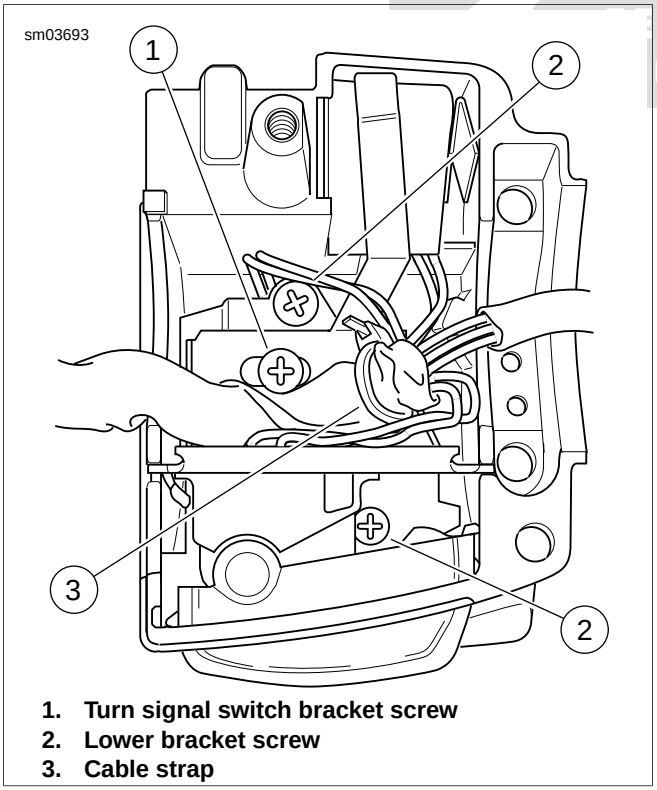
1. **Stoplight switch**
2. **Wedge**
3. **Switch wires**
4. **Lower switch housing**

Figure 7-120. Install Stoplight Switch



1. **Cable strap**
2. **Bracket**
3. **Right turn signal switch**

Figure 7-122. Insert Cable Strap in Switch Bracket



1. **Turn signal switch bracket screw**
2. **Lower bracket screw**
3. **Cable strap**

Figure 7-121. Lower Right Handlebar Switch Housing (Without Splices) - Classic/Ultra Models

Cruise Set/Resume Switch (Road King Classic and Ultra Models)

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. Pull bracket and switch from switch housing.
3. Cut wires 1.5 in. (38.1 mm) from old switch. Discard switch assembly.

NOTE

Replacement Cruise Set/Resume Switch wires are cut to length, 2.0 in. (50.8 mm), and partially stripped.

4. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
5. Fit **new** switch into cavity, so that it sits in a horizontal position (blue/black wire towards master cylinder). Properly installed, switch is captured by blocks cast into lower housing.
6. Keeping splices above bracket, install lower bracket (weld nut side down), so that lower step is positioned over switch. Slots in upper step engage two tabs on plastic insert (Road King Classic) or on body of Mode Select Switch (Ultra models).

NOTE

The Mode Select Switch is vertically oriented with the gray/white wire topside.

7. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. Use thru hole

in upper step of bracket to engage threaded hole in casting.

8. Note lettering for proper orientation and gently push keycap onto switch shaft.

Final Instructions

1. See Figure 7-122. Insert tapered end of **new**7.0 in. (178 mm) cable strap into round hole in turn signal switch bracket and then feed back through using adjacent hole. Reserve oblong hole for bracket screw.

NOTE

Be sure that all splices are positioned above the turn signal switch bracket.

2. Place turn signal switch assembly into housing aligning oblong hole in bracket with lower bracket weld nut (threaded boss on Road King Standard models). Be sure that bracket is fully seated. Tabs on each side of bracket are captured in slots cast into switch housing.

3. Start screw to secure bracket inside housing.

CAUTION

If routed incorrectly, wires can be pinched by casting or handlebar resulting in switch failure. (00542b)

4. Loop switch wires, so that spliced lengths are positioned as shown in Figure 7-123 or Figure 7-124.

5. Capturing conduit about 0.25 in. (6.4 mm) from end, securely tighten cable strap to draw conduit to bracket. Remove any excess cable strap material.

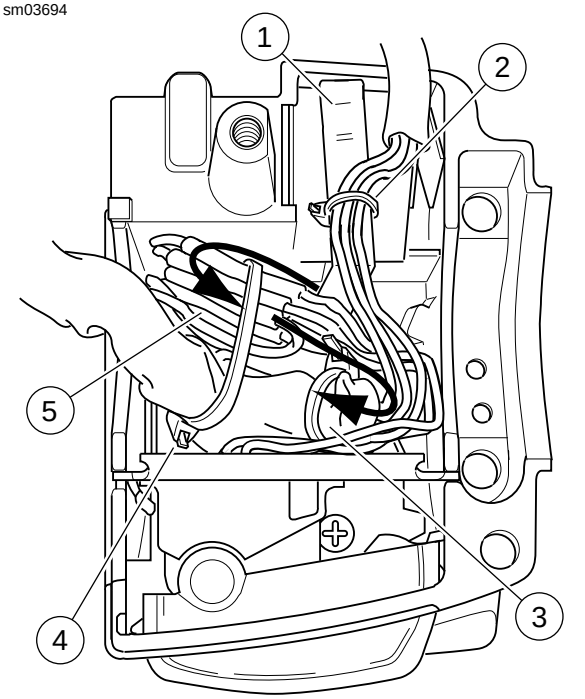
6. Install second 7.0 in. (178 mm) cable strap capturing conduit and wire splices. Securely tighten cable strap to draw splices to conduit. Remove any excess cable strap material.

7. Tighten screw to secure bracket inside housing.

8. Route wire bundle to upper switch housing by gently pressing conduit into channel next to angular arm of bracket. Secure bundle to arm using third cable strap.

 Cut any excess cable strap material. If necessary, bend angular arm of bracket downward to firmly secure Front Stoplight Switch in installed position.

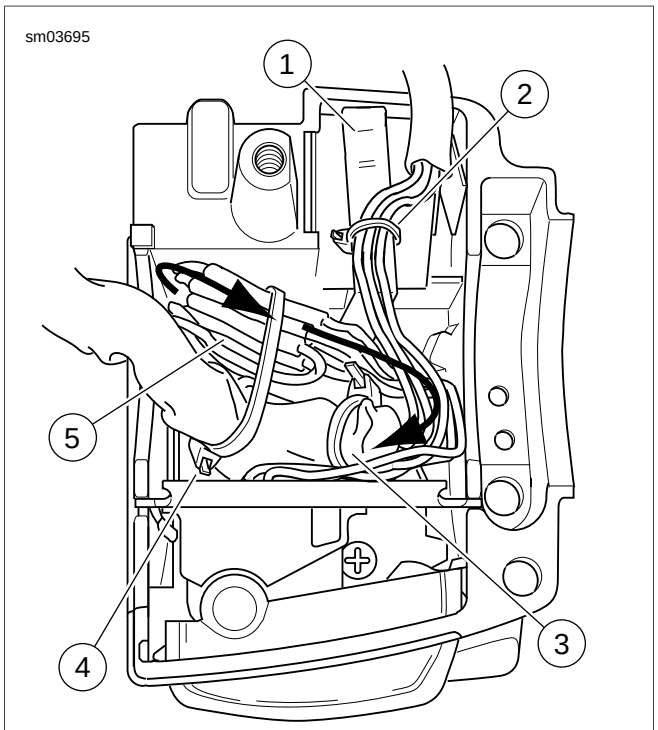
9. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Right Side Handlebar Switches.



1. **Angular arm**
2. **Cable strap (wire bundle to arm)**
3. **Cable strap (conduit to bracket)**
4. **Cable strap (splices to conduit)**
5. **Splices**

Figure 7-123. Mode Select Handlebar Switch Housing (Lower Right) - Classic/Ultra Models

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Angular arm**
2. **Cable strap (wire bundle to arm)**
3. **Cable strap (conduit to bracket)**
4. **Cable strap (splices to conduit)**
5. **Splices**

Figure 7-124. Cruise Control Handlebar Switch Housing (Lower Right) - Classic/Ultra Models

SPECIFIC REPAIR PROCEDURES: LEFT SIDE LOWER SWITCH HOUSINGS

Preliminary Instructions

1. From inside switch housing, carefully cut cable strap to free conduit from turn signal switch bracket, if present.
2. Remove screw to release turn signal switch bracket. Remove bracket and switch assembly from housing.

NOTE

On Classic and Ultra models, pull conduit back to introduce some slack in wires or the tight fit of the bundle will prevent removal of the switch bracket.

Turn-Left Signal Switch (All Models)

1. Cut wires 1.5 in. (38.1 mm) from old switch. Discard old switch assembly.

NOTE

Replacement Turn-Left Signal Switch wires are cut to length, 1.5 in. (38.1 mm), and partially stripped.

2. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.

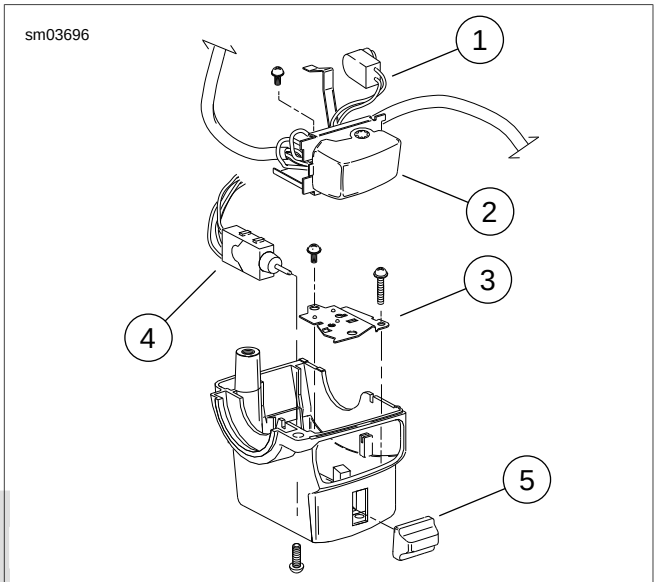
Clutch Interlock Switch

1. Cut wires 0.25 in. (6.4 mm) from old switch. Discard switch assembly.

NOTE

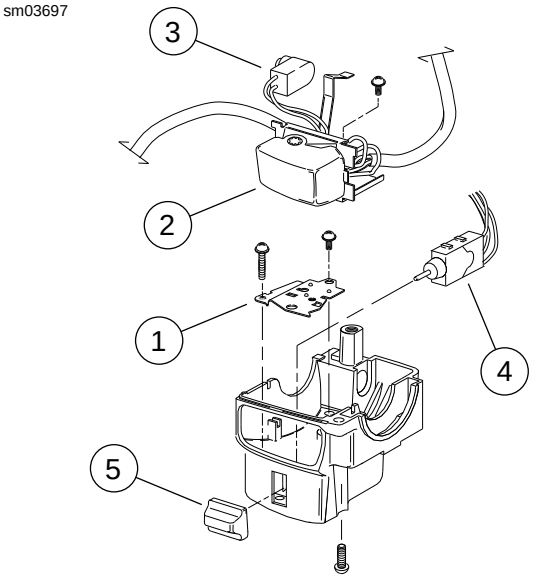
Replacement Clutch Interlock Switch wires are cut to length and partially stripped. Looking at backside, left side switch wire is 2.25 in. (57.2 mm) long, right side is 2.75 in. (70 mm) long.

2. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
3. Seat switch in cavity. Verify that plunger is square in bore and that boot is not compressed, collapsed or torn. Push down on switch, so that it bottoms against housing and wires run in groove at base of cavity.



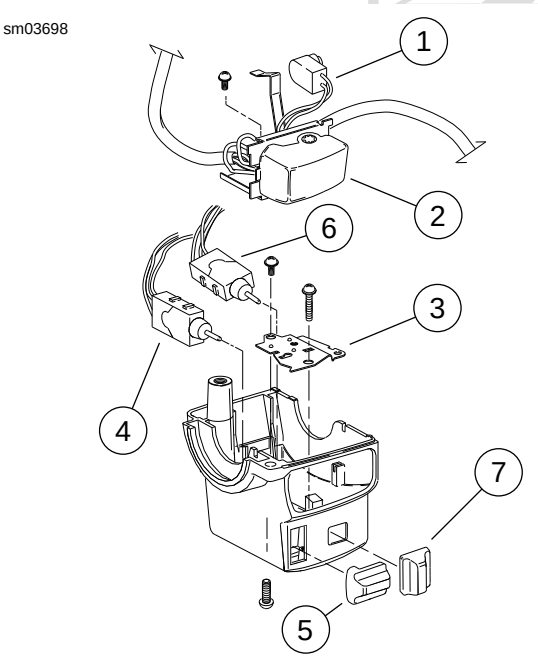
1. **Clutch interlock switch**
2. **Left turn signal switch and bracket**
3. **Lower bracket**
4. **Audio control switch**
5. **Audio switch keycap**

Figure 7-125. Lower Left Handlebar Switch Assembly (Classic)



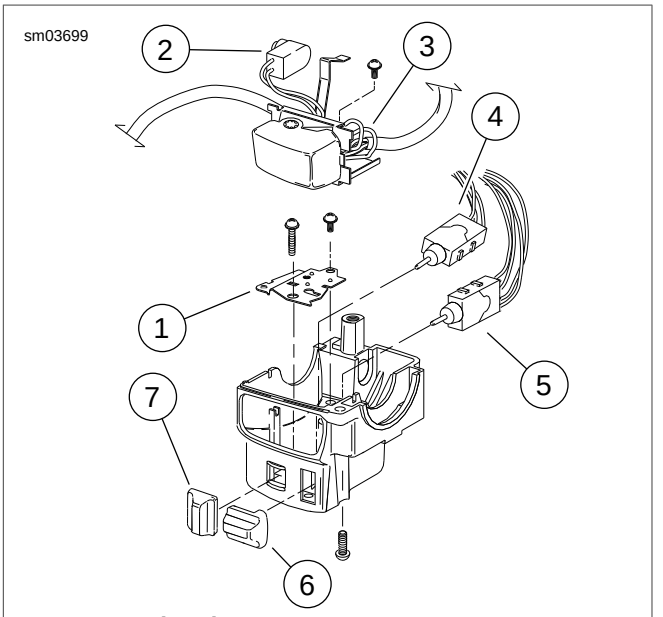
1. Lower bracket
2. Right turn signal switch and bracket
3. Stoplight switch
4. Mode select switch
5. Mode select keycap

Figure 7-126. Lower Right Handlebar Switch Assembly (Classic)



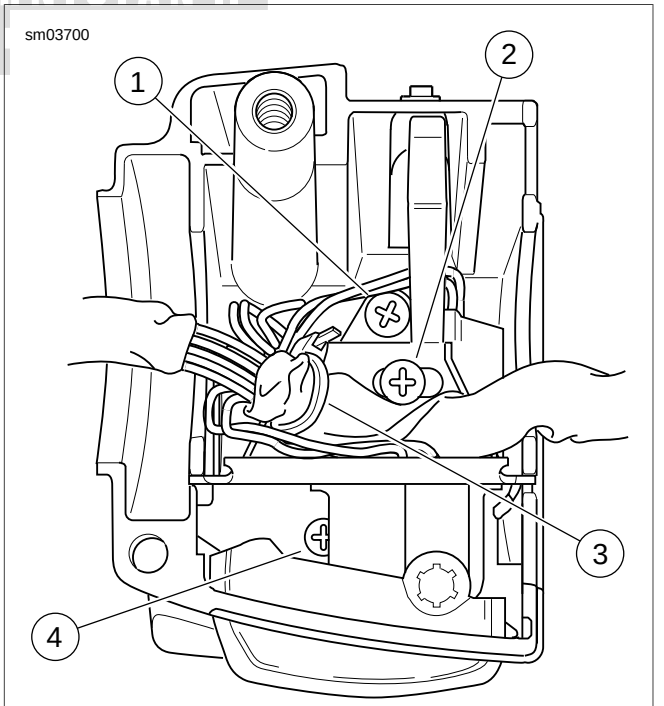
1. Clutch interlock switch
2. Left turn signal switch and bracket
3. Lower bracket
4. Audio control switch
5. Audio switch keycap
6. PTT switch
7. PTT switch keycap

Figure 7-127. Lower Left Handlebar Switch Assembly (Ultra)



1. Lower bracket
2. Stoplight switch
3. Right turn signal switch and bracket
4. Cruise control switch
5. Mode select switch
6. Mode select keycap
7. Cruise switch keycap

Figure 7-128. Lower Right Handlebar Switch Assembly (Ultra)



1. Lower bracket screw
2. Turn signal switch bracket screw
3. Cable strap
4. Lower bracket screw

Figure 7-129. Lower Left Handlebar Switch Housing (Without Splices) - Classic/Ultra Models

Audio Control Switch (Classic and Ultra Models)

1. Pull keycap from switch shaft.
2. See Figure 7-129. Remove two lower bracket screws. Pull bracket and switch from switch housing.
3. Cut wires 1.25 in. (31.8 mm) from old switch. Discard switch assembly.

NOTE

Replacement Audio Control Switch wires are cut to length, 2.25 in. (57.2 mm), and partially stripped.

4. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
5. Fit **new** switch into cavity, so that it sits on edge in a vertical position (gray/green wire topside). Properly installed, switch is captured by blocks cast into lower housing. Verify that switch shaft is aligned for proper keycap operation.
6. Place lower bracket into housing (with weld nut side down), but keep splices above bracket. Verify that slots in upper step of bracket engage two tabs on switch body.
7. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. To engage threaded hole in casting, use thru hole in lower step of bracket on Classic models, thru hole in upper step on Ultra.
8. Note lettering for proper orientation and gently push keycap onto switch shaft.

CB Push-To-Transmit Switch (Ultra Models)

1. Pull keycap from switch shaft.
2. See Figure 7-129. Remove two lower bracket screws. Pull bracket and switch from switch housing.
3. Cut wires 1.5 in. (38.1 mm) from old switch. Discard switch assembly.

NOTE

Replacement Push-to-Transmit Switch wires are cut to length, 2.0 in. (50.8 mm), and partially stripped.

4. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
5. Fit **new** switch into cavity, so that it sits in a horizontal position (brown/black wire towards clutch lever bracket). Properly installed, switch is captured by blocks cast into lower housing.
6. Keeping splices above bracket, install lower bracket (weld nut side down), so that lower step is positioned over Push-to-Transmit Switch (horizontally oriented). Slots in upper step engage two tabs on body of Audio Control Switch (vertically oriented with gray wire topside).
7. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. To engage threaded hole in casting, use thru hole in upper step of bracket.
8. Note lettering for proper orientation and gently push keycap onto switch shaft.

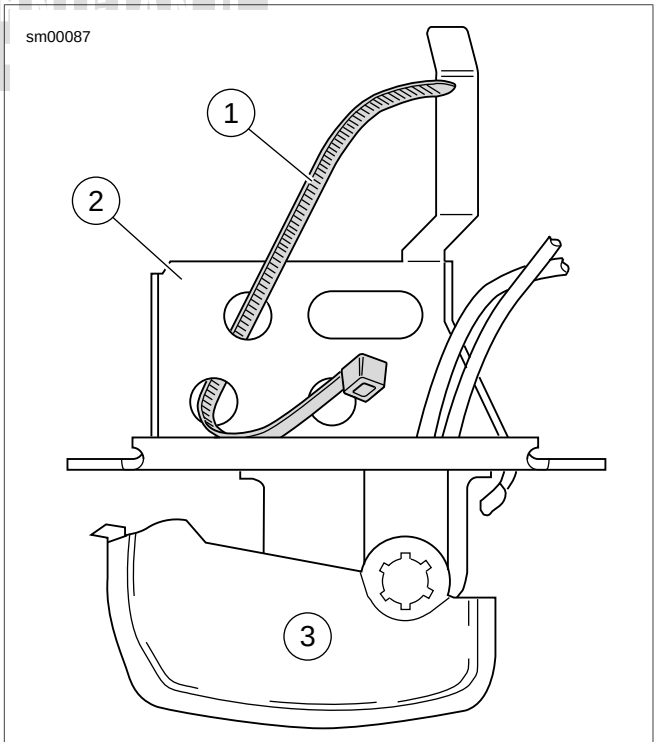
Cruise On/Off Switch (Road King Classic Models)

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. Pull bracket and switch from switch housing.
3. Cut wires 1.5 in. (38.1 mm) from old switch. Discard switch assembly.

NOTE

Cut replacement Cruise On/Off Switch wires to 2.0 in. (50.8 mm) and strip 0.5 in. (12.7 mm) of insulation.

4. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
5. Fit **new** switch into cavity, so that it sits in a horizontal position (orange/white wire towards clutch lever bracket). Properly installed, switch is captured by blocks cast into lower housing.
6. Keeping splices above bracket, install lower bracket (weld nut side down), so that lower step is positioned over switch. Slots in upper step engage two tabs on plastic insert.
7. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. Use thru hole in upper step of bracket to engage threaded hole in casting.
8. Note lettering for proper orientation and gently push keycap onto switch shaft.



1. **Cable strap**
2. **Bracket**
3. **Left turn signal switch**

Figure 7-130. Insert Cable Strap in Switch Bracket

Final Instructions

1. See Figure 7-130. Insert tapered end of **new** cable strap into round hole in turn signal switch bracket and then feed back through using adjacent hole. Reserve oblong hole for bracket screw.

NOTE

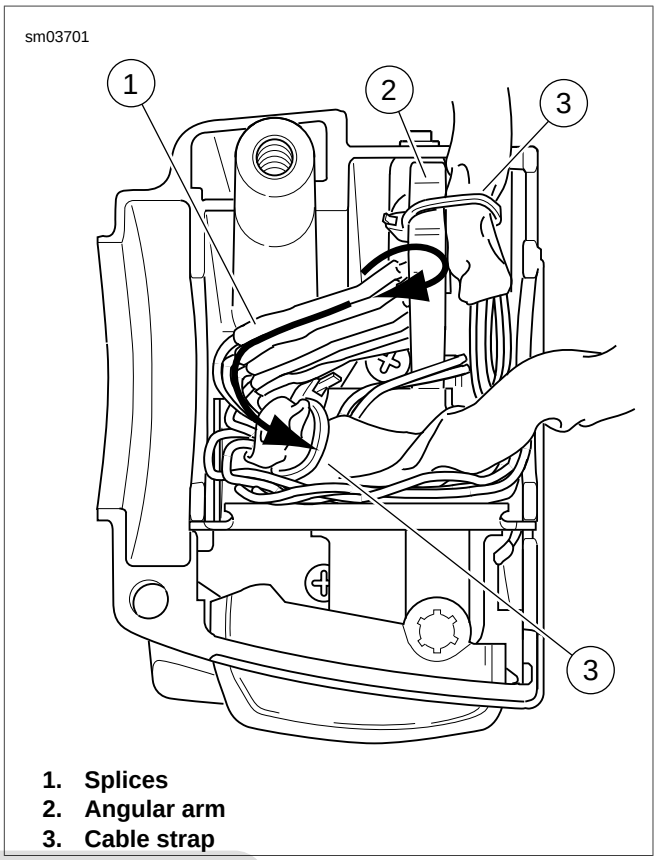
Be sure that all splices are positioned above the turn signal switch bracket.

2. Place turn signal switch assembly into housing aligning oblong hole in bracket with lower bracket weld nut (threaded boss on Road King Standard models). Be sure that bracket is fully seated. Tabs on each side of bracket are captured in slots cast into switch housing.
3. Start screw to secure bracket inside housing.

CAUTION

If routed incorrectly, wires can be pinched by casting or handlebar resulting in switch failure. (00542b)

4. Loop switch wires, so that spliced lengths are positioned as shown in Figure 7-131.
5. Capturing conduit about 0.25 in. (6.4 mm) from end, securely tighten cable strap to draw conduit to bracket. Remove any excess cable strap material.
6. Tighten screw to secure bracket inside housing.
7. See Figure 7-131. Route wire bundle to upper switch housing below and then forward of the main wire harness positioning conduit in channel next to angular arm of bracket. Secure bundle to arm using **new** cable strap. Cut any excess cable strap material.
8. See 7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Left Side Handlebar Switches.



1. **Splices**
2. **Angular arm**
3. **Cable strap**

Figure 7-131. Lower Left Handlebar Switch Housing (With Splices) - Classic/Ultra Models

GENERAL REPAIR PROCEDURES

1. To better access wires and avoid damaging conduit with radiant heating device, push conduit back and secure with extra 7.0 in. (178 mm) cable strap in kit.
2. Strip 0.5 in. (12.7 mm) of insulation off switch wires. Twist stripped ends of switch wires until all strands are tightly coiled.
3. Cut dual wall heat-shrink tubing supplied in kit into 1.0 in. (25.4 mm) segments. Slide tubing over each wire of new switch assembly.

NOTE

If absent from kit, obtain heat shrink tubing (Part No. 72266-94) and two 7.0 in. (178 mm) cable straps (Part No. 10181).

4. See Figure 7-132. Matching wire colors, mate old and new switch wires and splice as follows:
 a. Hold the wires so that the stripped ends cross (1). Note that the wire on the left is on top and two-thirds of its stripped length lies beyond the point where they intersect. Looking at the other wire, only 1/3 of its stripped length lies beyond the intersection point.
 b. Holding the wires together at their juncture, start the splice by tightly twisting the top one-third length of the right hand wire over the left (2).
 c. Tightly coil the remaining two-thirds of the left hand wire around the right (3).
 d. Solder the spliced connections.

NOTE

For best results, do one wire at a time.

5. Center the heat-shrink tubing over the soldered splices.

⚠WARNING

Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)

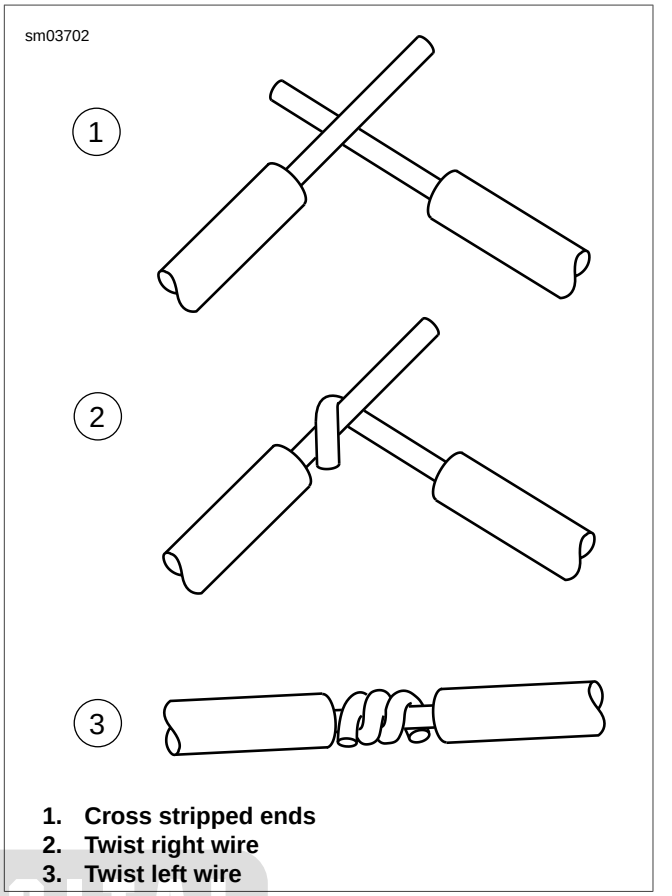
- **Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.**
- **Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.**
- **Always keep hands away from tool tip area and heat shrink attachment.**

6. See Figure 7-133. Using the UltraTorch UT-100, Robinair Heat Gun with heatshrink attachment or other suitable radiant heating device, uniformly heat the heat-shrink tubing to insulate and seal the soldered connections. Apply heat just until the meltable sealant exudes out both ends of the tubing and it assumes a smooth cylindrical appearance.

NOTE

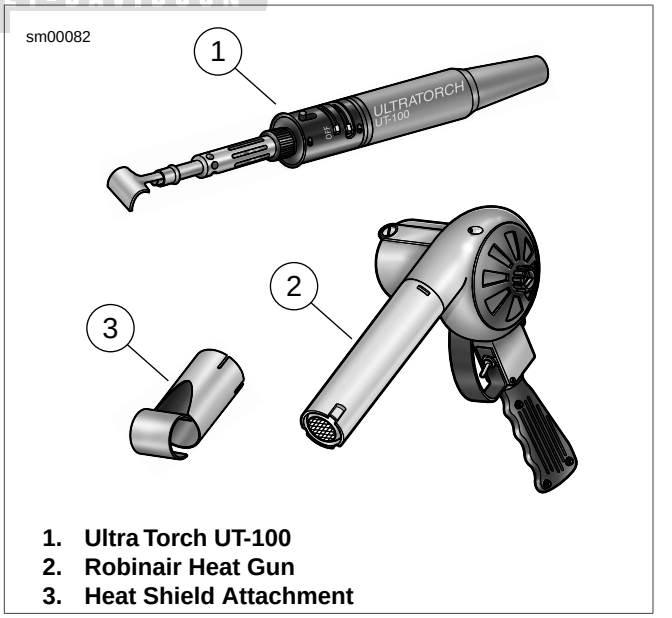
Electrically connected solder outside the tubing may cause a short to ground resulting in switch failure.

7. Inspect the melted sealant for solder beads. Excess solder or heat may force some solder out with the melted sealant. Use a small needle nose pliers to remove any solder found. Briefly heat the connection to reseal the tubing if solder beads were removed. Use less solder or reduce heating time or intensity when doing subsequent splices.
8. Cut cable strap compressing conduit and move to its original position.



1. **Cross stripped ends**
2. **Twist right wire**
3. **Twist left wire**

Figure 7-132. Splice Switch Wires



1. **Ultra Torch UT-100**
2. **Robinair Heat Gun**
3. **Heat Shield Attachment**

Figure 7-133. Radiant Heating Devices

ASSEMBLY: RIGHT SIDE HANDLEBAR SWITCHES

1. If replacing lower housing switches, proceed to next step. If replacing upper housing switches, proceed to step 8.

2. With concave side facing upward, install friction shoe so that pin hole is over point of adjuster screw (non cruise equipped models only).

NOTE

The friction shoe is a loose fit and may fall out or become dislodged if lower switch housing is turned upside down or shaken.

3. Position lower switch housing beneath throttle grip.
4. Position upper switch housing over handlebar and lower switch housing. Verify that wire harness conduit runs in depression at bottom of handlebar.
5. Start upper and lower switch housing screws, but do not tighten.
6. Position brake lever/master cylinder assembly inboard of switch housing assembly engaging tab on lower switch housing in groove at top of brake lever bracket.
7. Align holes in handlebar clamp with those in master cylinder housing and start lower screw (with flat washer). Position for rider comfort. Beginning with top screw, tighten screws to 72-80 **in-lbs** (8.0-9.0 Nm).
8. Tighten lower and upper switch housing screws to 35-45 **in-lbs** (4.0-5.0 Nm).

NOTE

Always tighten lower switch housing screw first, so that any gap between upper and lower housings is at front of switch assembly.

9. Remove cardboard insert between brake lever and lever bracket.
10. Test switches for proper operation.

ASSEMBLY: LEFT SIDE HANDLEBAR SWITCHES

1. If replacing lower housing switches, proceed to next step. If replacing upper housing switches, proceed to step 6.
2. Install upper and lower switch housings on handlebar. Be sure that ribs on outboard side of switch housings fit in grooves molded into grip. Verify that wire harness conduit runs in depression at bottom of handlebar.
3. Start upper and lower switch housing screws, but do not tighten.
4. Position clutch hand lever assembly inboard of switch housing assembly engaging tab on lower switch housing in groove at bottom of clutch lever bracket.
5. Align holes in handlebar clamp with those in clutch lever bracket and start lower screw (with flat washer). Position for rider comfort. Beginning with top screw, tighten screws to 72-108 **in-lbs** (8.0-12.0 Nm).
6. Tighten lower and upper switch housing screws to 35-45 **in-lbs** (4.0-5.0 Nm).

NOTE

Always tighten lower switch housing screw first, so that any gap between upper and lower housings is at front of switch assembly.

7. Test switches for proper operation.

INSTALLATION

NOTE

While there are four different switch configurations for Touring models (Road King, Road King Classic, Classic and Ultra), the installation procedures are the same. To simplify these instructions, only the Road King switch configuration is represented in the photographs and illustrations which follow.

Right Handlebar Controls

1. With concave side facing upward, install friction shoe so that pin hole is over point of adjuster screw (non cruise equipped models only).

NOTE

The friction shoe is a loose fit and may fall out or become dislodged if lower switch housing is turned upside down or shaken.

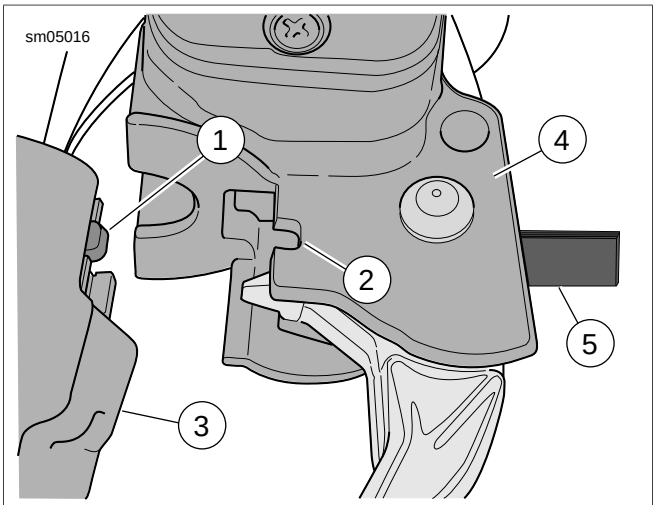
2. Position lower switch housing beneath the throttle grip.
3. Position upper switch housing over handlebar and lower switch housing.
4. Verify that wire harness conduit runs in the depression at bottom of handlebar. Be sure that upper switch housing harness will not be pinched under handlebar when switch housing screws are tightened.
5. Start upper and lower switch housing screws, but do not tighten.
6. See Figure 7-134. Position brake lever/master cylinder assembly inboard of switch housing assembly engaging tab on lower switch housing in groove at top of brake lever bracket.
7. Align holes in handlebar clamp with those in master cylinder housing and start two screws (with flat washers). Position for rider comfort. Beginning with top screw, tighten screws to 72-80 **in-lbs** (8.0-9.0 Nm).
8. Tighten lower and upper switch housing screws to 35-45 **in-lbs** (4.0-5.0 Nm).

NOTE

Always tighten lower switch housing screw first, so that any gap between upper and lower housings is at front of switch.

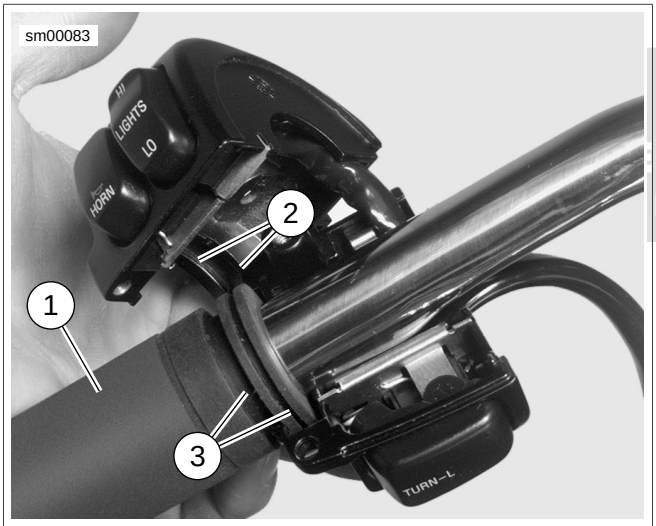
9. Remove cardboard insert between brake lever and lever bracket.
10. Secure wire harness conduit to handlebar using two new cable straps. Position first cable strap approximately 4.0-5.0 in. (102-127 mm) from handlebar clamp. Cut any excess cable strap material.
11. Test switches for proper operation.

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1. **Tab**
2. **Groove**
3. **Switch housing assembly**
4. **Brake lever bracket**
5. **Cardboard insert**

Figure 7-134. Remove Master Cylinder/Brake Lever Assembly



1. **Grip sleeve**
2. **Ribs**
3. **Grooves**

Figure 7-135. Install Left Handlebar Switch Housings

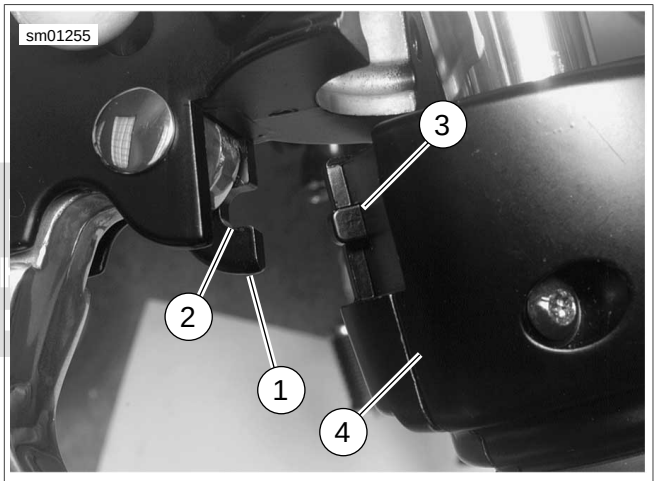
Left Handlebar Controls

1. Install **new** hand grip, if removed. See 2.26 HANDLEBARS, Left Hand Grip.
2. See Figure 7-135. Install upper and lower switch housings on handlebar. Be sure that ribs on outboard side of switch housings fit in grooves molded into grip.
3. Verify that wire harness conduit runs in groove at bottom of handlebar. Be sure that upper switch housing harness will not be pinched under handlebar when switch housing screws are tightened.
4. Start upper and lower switch housing screws, but do not tighten.
5. See Figure 7-136. Position clutch hand lever assembly inboard of switch housing assembly engaging tab on lower switch housing in groove at bottom of clutch lever bracket.
6. Align holes in handlebar clamp with those in clutch lever bracket and start two screws (with flat washers). Position for rider comfort. Beginning with top screw, tighten screws to 72-108 **in-lbs** (8.0-12.0 Nm).
7. Tighten lower and upper switch housing screws to 35-45 **in-lbs** (4.0-5.0 Nm).

NOTE

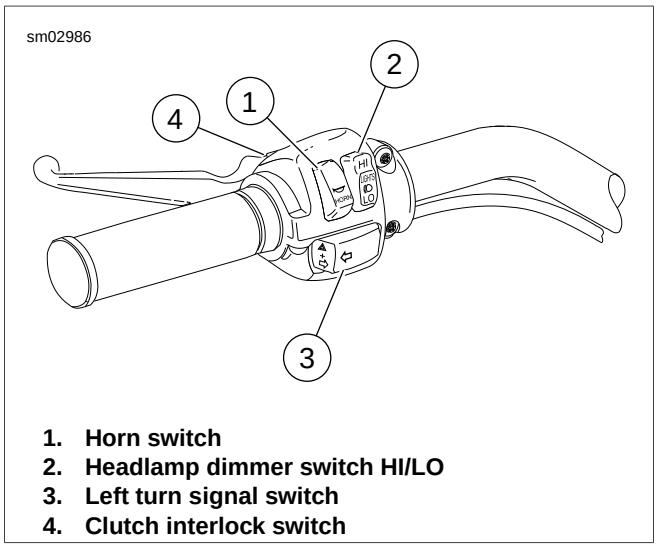
Always tighten lower switch housing screw first, so that any gap between upper and lower housings is at front of switch.

8. Secure wire harness conduit to handlebar using two **new** cable straps. Position first cable strap approximately 4.0-5.0 in. (102-127 mm) from handlebar clamp. Cut any excess cable strap material.
9. Test switches for proper operation.



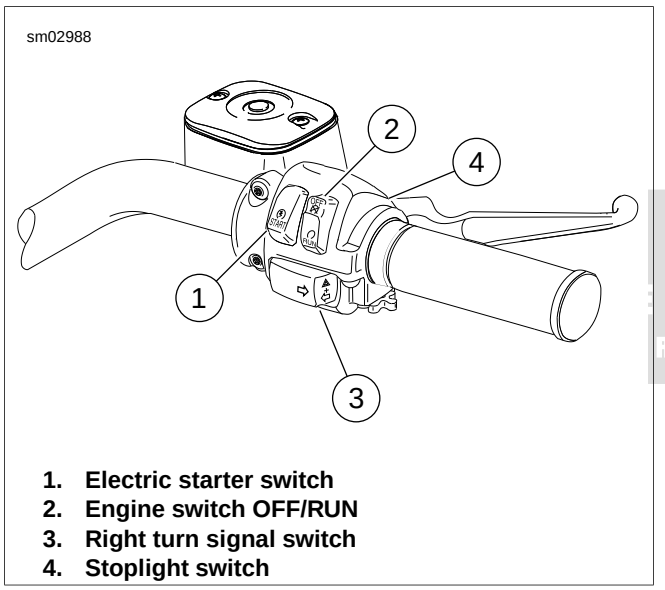
1. **Clutch lever bracket**
2. **Groove**
3. **Tab**
4. **Switch housing assembly**

Figure 7-136. Fit Clutch Lever Bracket to Left Handlebar Switch Housing



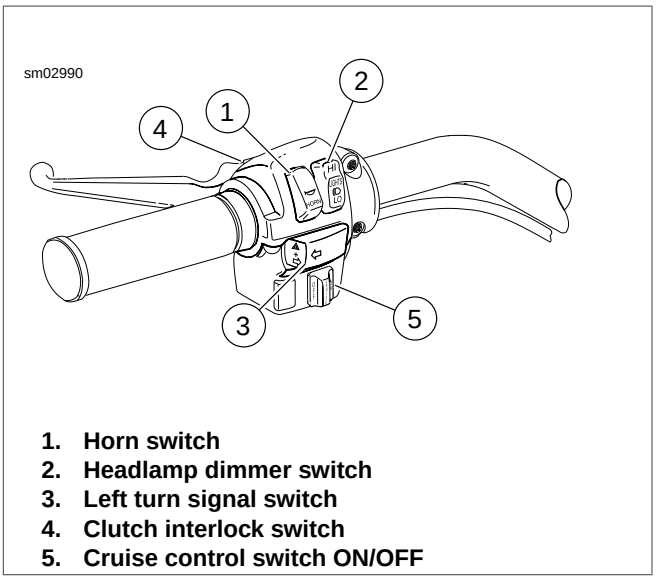
1. Horn switch
2. Headlamp dimmer switch HI/LO
3. Left turn signal switch
4. Clutch interlock switch

Figure 7-137. Road King Left Handlebar Controls



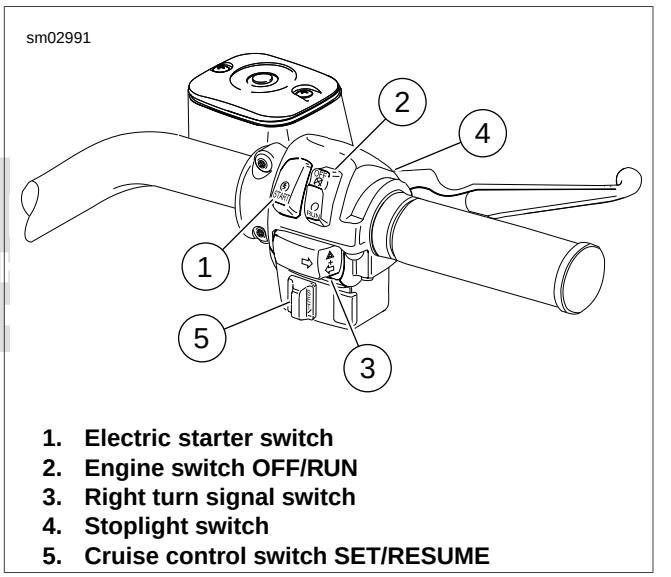
1. Electric starter switch
2. Engine switch OFF/RUN
3. Right turn signal switch
4. Stoplight switch

Figure 7-138. Road King Right Handlebar Controls



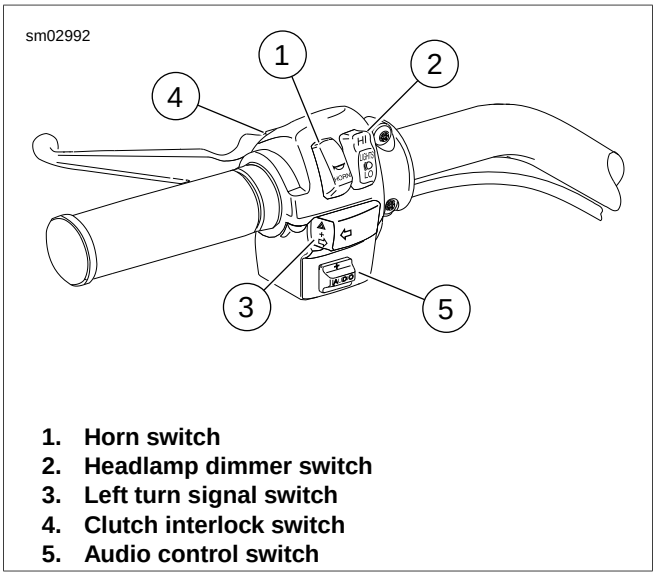
1. Horn switch
2. Headlamp dimmer switch
3. Left turn signal switch
4. Clutch interlock switch
5. Cruise control switch ON/OFF

Figure 7-139. Road King Classic Left Handlebar Controls



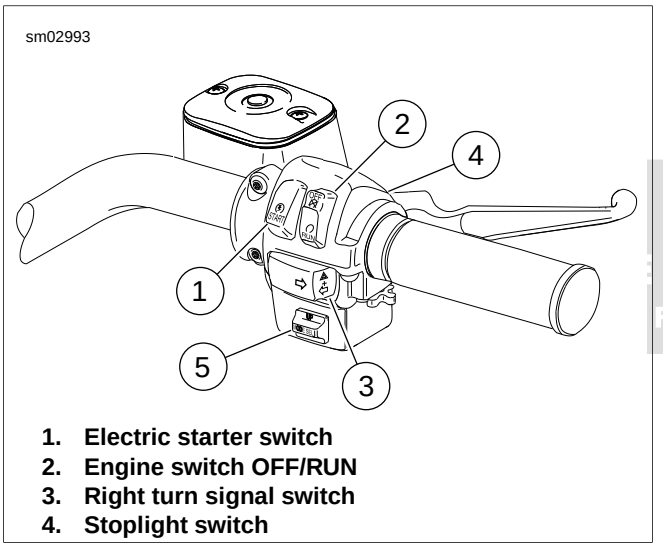
1. Electric starter switch
2. Engine switch OFF/RUN
3. Right turn signal switch
4. Stoplight switch
5. Cruise control switch SET/RESUME

Figure 7-140. Road King Classic Right Handlebar Controls



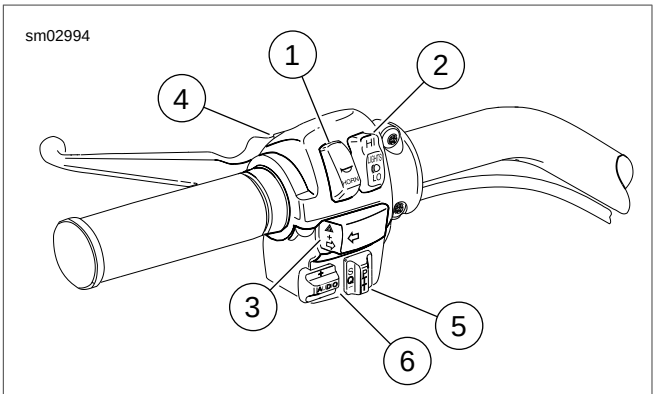
1. Horn switch
2. Headlamp dimmer switch
3. Left turn signal switch
4. Clutch interlock switch
5. Audio control switch

Figure 7-141. Classic Left Handlebar Controls



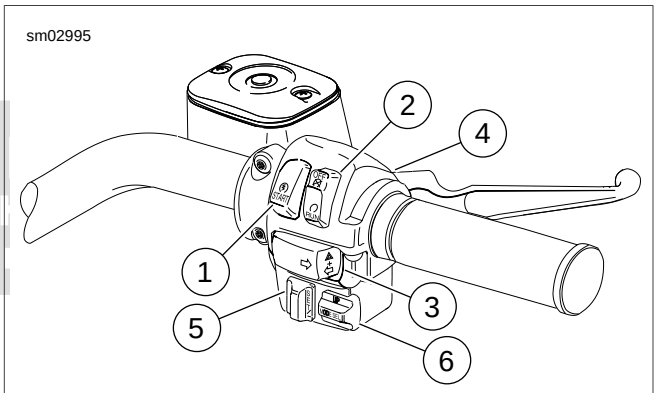
1. Electric starter switch
2. Engine switch OFF/RUN
3. Right turn signal switch
4. Stoplight switch

Figure 7-142. Classic Right Handlebar Controls



1. Horn switch
2. Headlamp dimmer switch
3. Left turn signal switch
4. Clutch interlock switch
5. Squelch control and driver switch PUSH/TRANSMIT
6. Audio control switch

Figure 7-143. Ultra Left Handlebar Controls



1. Electric starter switch
2. Engine switch OFF/RUN
3. Right turn signal swtich
4. Stoplight switch
5. Mode select switch
6. Cruise control switch SET/RESUME

Figure 7-144. Ultra Right Handlebar Controls

NOTES

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NOTES

AMP MULTILOCK CONNECTORS A.1

AMP MULTILOCK CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41609	AMP MULTILOCK CRIMPER

General

AMP Multilock connectors are found between wire harnesses and component wiring and may be either floating or anchored to the frame with attachment clips.

See Figure A-1. Attachment clips (1) on the pin housings are fitted to T-studs on the motorcycle frame. The T-studs identify OE connector locations. To maintain serviceability, always return connectors to OE locations after service.

Obtain the necessary tools to repair the connector and terminals.

NOTE

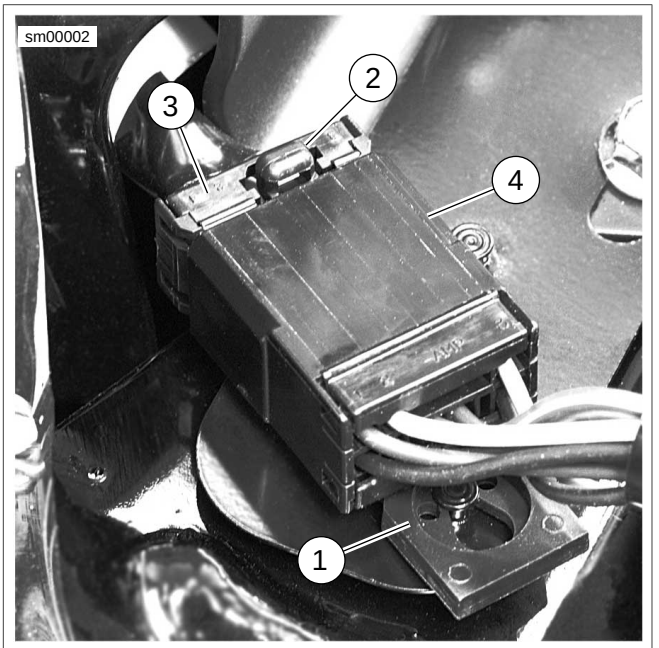
For terminal crimping use the AMP MULTILOCK CRIMPER (Part No. HD-41609).

Separating Pin and Socket Housings

1. If necessary, slide connector attachment clip T-stud to the large end of the opening.
2. See Figure A-1. Depress the release button (2) on the socket terminal side of the connector and pull the socket housing (3) out of the pin housing (4).

Mating Pin and Socket Housings

1. Hold the housings to match wire color to wire color.
2. Insert the socket housing into the pin housing until it snaps in place.
3. If OE location is a T-stud, fit large opening end of attachment clip over T-stud and slide connector to engage T-stud to small end of opening.



1. **Attachment clip**
2. **Release button**
3. **Socket housing**
4. **Pin housing**

Figure A-1. AMP Multilock Connector

Removing Terminals from Housing

1. See Figure A-2. Bend back the latch (1) to free one end of secondary lock (2) then repeat on the opposite end. Hinge the secondary lock outward.
2. Look in the terminal side of the connector (opposite the secondary lock) and note the cavity next to each terminal.
3. Insert a pick or pin into the terminal cavity until it stops.

NOTE

If socket/pin terminal tool is not available, a push pin/safety pin or a Snap-on pick (Part No. TT600-3) may be used.

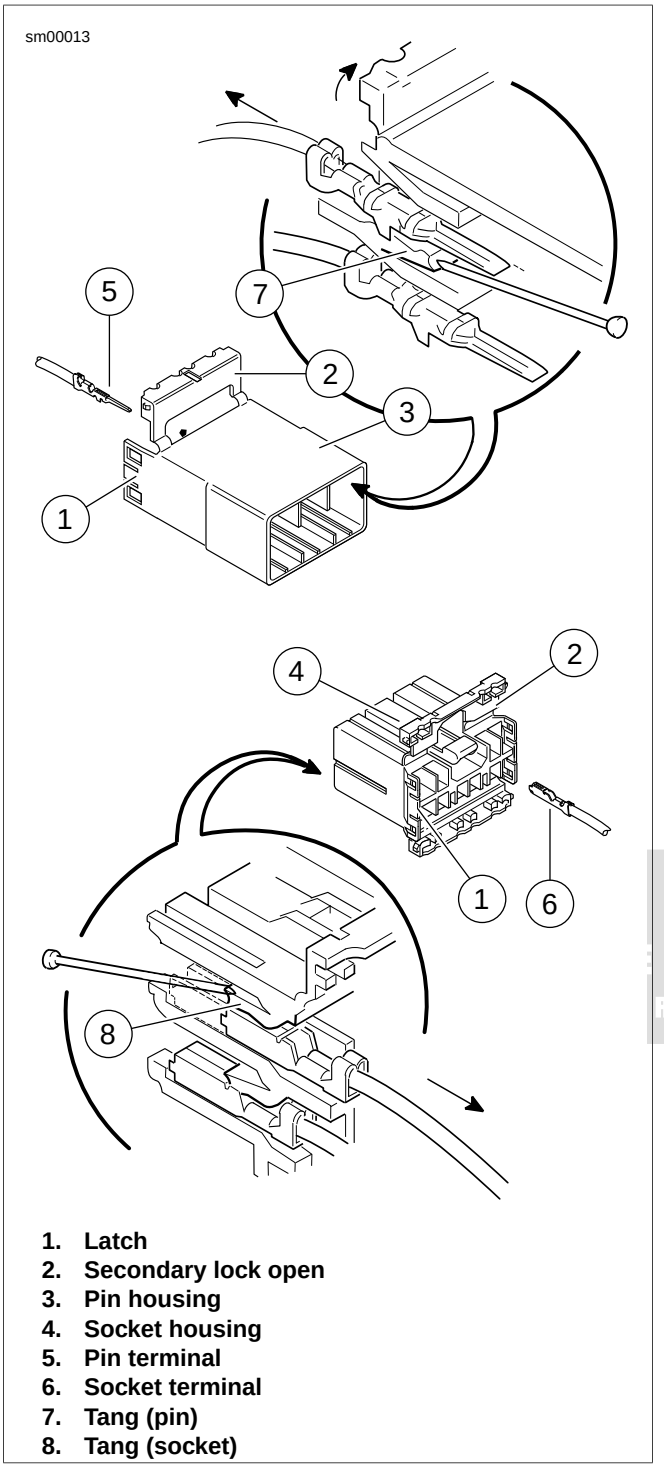
4. Press the tang in the housing to release the terminal.
 a. **Socket:** Lift the socket tang (8) up.
 b. **Pin:** Press the pin tang (7) down.

NOTE

A "click" is heard if the tang is released.

5. Gently tug on wire to pull wire and terminal from cavity.

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1. **Latch**
2. **Secondary lock open**
3. **Pin housing**
4. **Socket housing**
5. **Pin terminal**
6. **Socket terminal**
7. **Tang (pin)**
8. **Tang (socket)**

Figure A-2. AMP Multilock Connector: Socket and Pin Housings

Inserting Terminals into Housing

NOTE

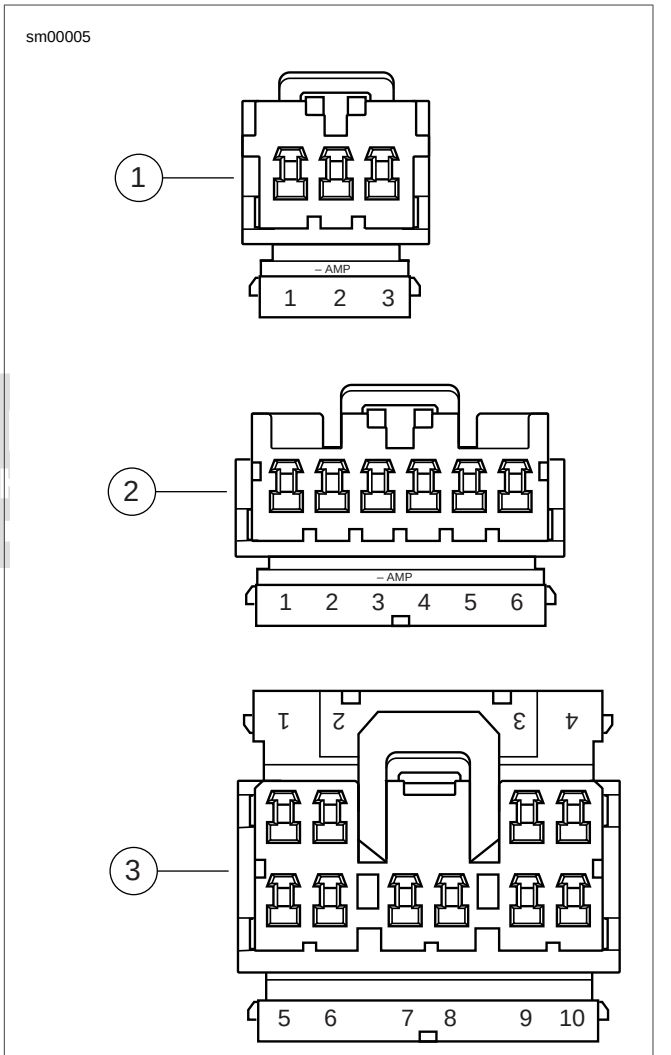
See Figure A-3. Cavity numbers are stamped into the secondary locks of both the socket and pin housings. Match the wire color to the cavity number found on the wiring diagram.

1. Hold the terminal so the catch faces the tang in the chamber. Insert the terminal into its numbered cavity until it snaps in place.

NOTES

- *Up and down can be determined by the position of the release button, the button is the top of the connector.*
- *On the pin side of the connector, tangs are positioned at the bottom of each cavity, so the slot in the pin terminal (on the side opposite the crimp tails) must face downward.*
- *On the socket side, tangs are at the top of each cavity, so the socket terminal slot (on the same side as the crimp tails) must face upward.*

2. Gently tug on wire end to verify that the terminal is locked in place.
3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.



1. **3-place housing**
2. **6-place housing**
3. **10-place housing**

Figure A-3. AMP Multilock Connector: Cavity Numbers on Secondary Locks (Socket Housings Shown)

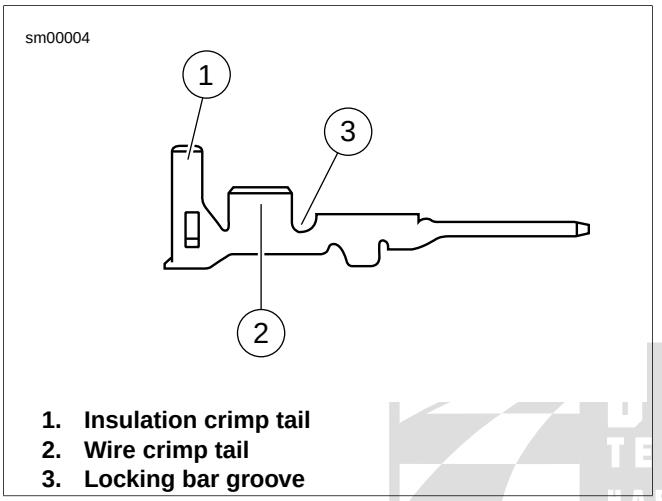
Preparing Wire Leads for Crimping

1. Strip 5/32 in. (4.0 mm) of insulation from the wire lead.

2. See Figure A-4 and Figure A-5. Select the pin/socket terminals from the parts catalog and identify the insulation crimp tails (1) and the wire crimp tails (2) and the groove for the crimp tool locking bar (3).
3. Identify the wire lead gauge and the corresponding crimper tool and nesting die. Refer to Table A-1.

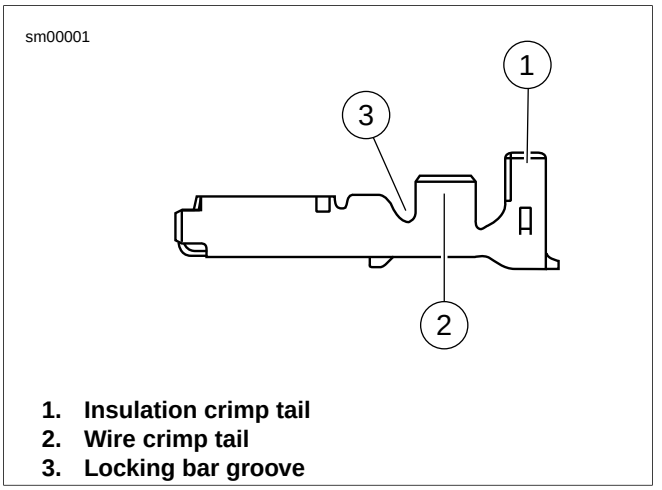
Table A-1. AMP Multilock Connector: Crimp Tool Wire Gauge/Nest

WIRE GAUGE	NEST
20	Front
16	Middle
18	Rear



1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

Figure A-4. AMP Multilock Connector: Pin Terminal



1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

Figure A-5. AMP Multilock Connector: Socket Terminal

Crimping Terminals to Leads

NOTE

Crimping with an Amp Multilock tool is a one step operation. One squeeze crimps both the wire core and the insulation tails.

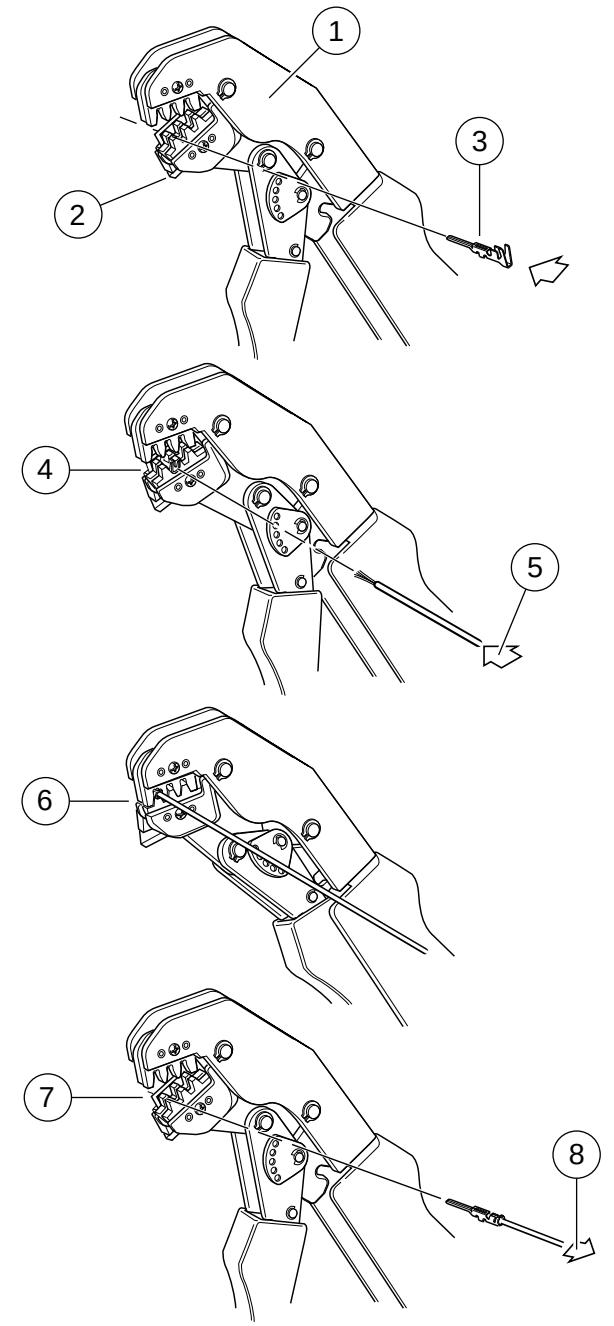
1. See Figure A-6. Squeeze the handles to cycle the AMP MULTILOCK CRIMPER (Part No. HD-41609) to the fully open position (1).
2. Raise locking bar by pushing up on bottom flange (2).

NOTE

See Figure A-4 and Figure A-5. Hold the terminal with the insulation crimp tail (1) facing up. The tool will hold the terminal by the locking bar groove (3) and crimp the wire crimp tail (2) around the bare wire of the stripped lead and the insulation crimp tail around the insulation.

3. See Figure A-6. With the insulation crimp tail facing upward, insert terminal (pin or socket) (3) through the locking bar, so that the closed side of the terminal rests on the nest of the crimp tool.
4. Release locking bar to lock position of contact (4). When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
5. Insert stripped end of lead (5) until ends make contact with locking bar.
6. Verify that wire is positioned so that wire crimp tails squeeze bare wire strands, while insulation crimp tails fold over the wire lead insulation.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
8. Raise up locking bar (7) and remove crimped terminal.

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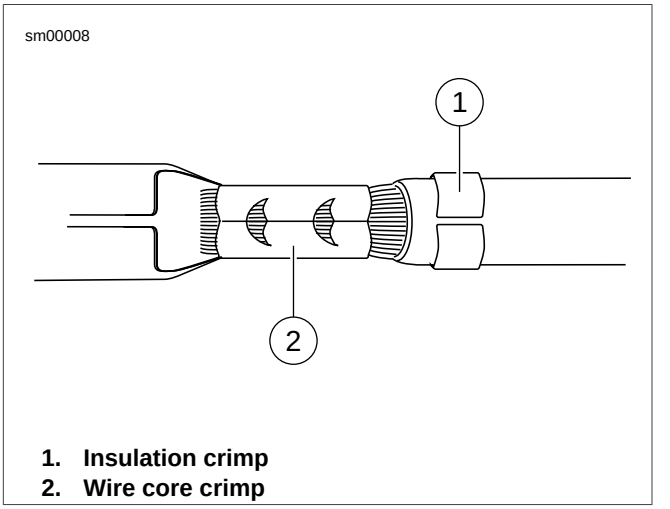


1. Open position
2. Locking bar flange
3. Insert contact
4. Release locking bar
5. Insert lead
6. Squeeze
7. Raise locking bar
8. Remove crimped terminal

Figure A-6. AMP Multilock Connector: Terminal Crimping Procedure

Inspecting Crimped Terminals

See Figure A-7. Inspect the wire core crimp (2) and insulation crimp (1). Distortion should be minimal.



1. Insulation crimp
2. Wire core crimp

Figure A-7. AMP Multilock Connector: Terminal Crimp

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AUTOFUSE ELECTRICAL CONNECTORS A.2

AUTOFUSE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
GA500A	SNAP-ON TERMINAL PICK

General

Autofuse electrical connector terminals are found in ignition switches and some fuse blocks.

Disassembly

1. Obtain SNAP-ON TERMINAL PICK (Part No. GA500A).
2. See Figure A-8 or Figure A-9. Insert smallest pair of pins into chamber on mating end of socket housing to depress tangs on each side of terminal simultaneously.
3. Gently pull on wire to remove terminal from wire end of socket housing.
4. If necessary, crimp **new** terminals on wires.

Assembly

1. Using a thin flat blade, like that on a hobby knife, carefully bend tang on each side of terminal outward away from terminal body.
2. With the open side of the terminal facing rib on wire end of socket housing, insert terminal into chamber until it locks in place.

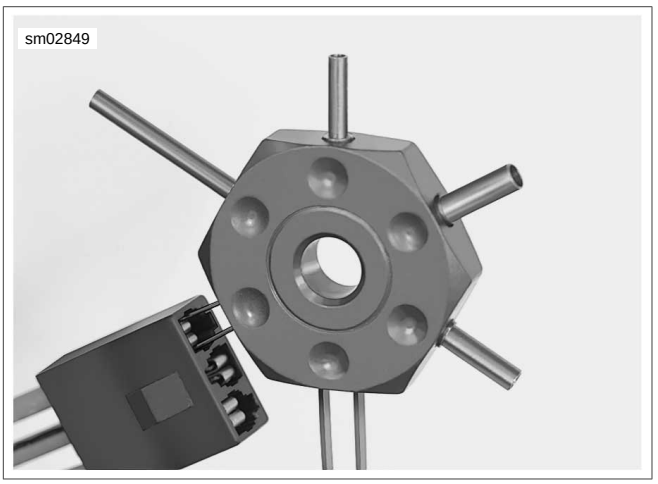


Figure A-8. Removing Autofuse Terminal from Ignition Switch

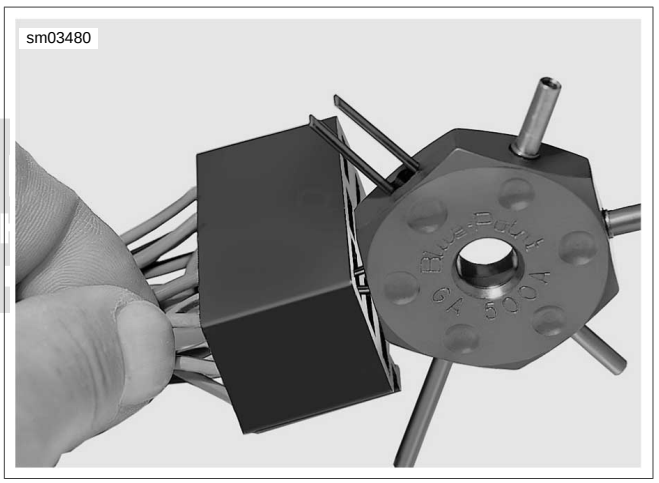


Figure A-9. Removing Autofuse Terminal from Fuse Block

DELPHI CONNECTORS A.3

DELPHI CONNECTOR REPAIR

General

Delphi connectors are embossed with the brand name, Delphi, on the housing latch.

Separating Pin and Socket Housings

See Figure A-10. Bend back the external latch(es) slightly and separate pin and socket halves of connector.

Mating Pin and Socket Housings

Push pin and socket halves of connector together until external latch(es) engage.

Removing Socket Terminals

NOTE

Although the parts of the different Delphi connectors vary in appearance, the instructions which follow will work for all. The only exception is the oil pressure sender connector [139B], the terminals of which are removed like the Packard push-to-seat connectors. Therefore, see A.10 PACKARD 150 METRI-PACK CONNECTORS to remove/install terminals in this connector.

1. See Figure A-11. If present, free one side of wire lock (1) from ear on wire end of socket housing, then release the other side. Release wires from channels in wire lock and remove from socket housing.
2. Use a fingernail to pry colored terminal lock (2) loose and then remove from mating end of socket housing.
3. Using a thin flat blade, like the unsharpened edge of a hobby knife, gently pry tang (3) outward away from terminal, and then tug on wire to back terminal out wire end of chamber. Do not pull on wire until tang is released or terminal will be difficult to remove.

Installing Socket Terminals

NOTE

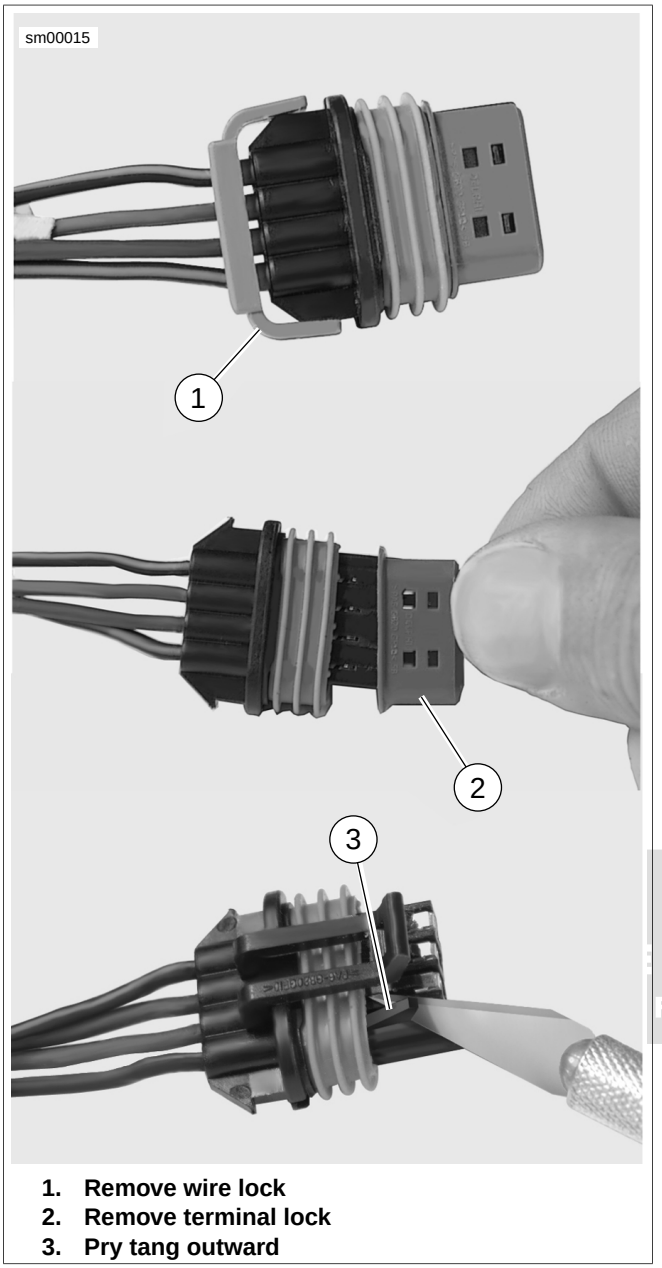
For wire location purposes, alpha or numeric characters are stamped into the wire end of each socket housing.

1. Gently push tang on socket housing inward toward chamber. With the open side of the terminal facing the tang, push terminal into chamber at wire end of socket housing.
2. Gently tug on wire to verify that terminal is locked and will not back out of chamber. If necessary, use fingernail to push tang into engagement with terminal.
3. Install colored terminal lock onto mating end of socket housing.
4. If present, seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.



Figure A-10. Delphi Connector: Socket Housing Latch

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1. **Remove wire lock**
2. **Remove terminal lock**
3. **Pry tang outward**

Figure A-11. Delphi Connector: Removing Socket Terminals

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DELPHI MAIN FUSE HOUSING A.4

DELPHI MAIN FUSE HOUSING REPAIR

Removing Socket Terminals

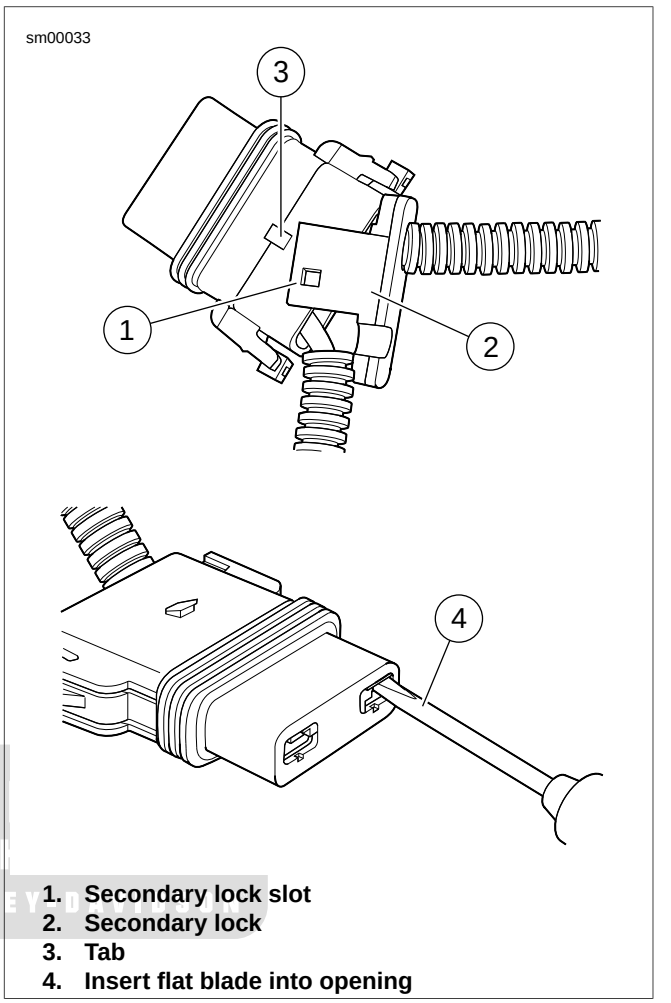
1. Disconnect battery. See 1.17 BATTERY MAINTENANCE.
2. Remove fuse connector from left-side electrical caddy. See 7.7 ELECTRICAL CADDIES.
3. See Figure A-12. Disengage slots (1) on secondary lock (2) from tabs (3) and remove secondary lock.
4. Insert flat blade of pick or small screwdriver into opening (4) until it stops.
5. Tug on cable to pull socket from connector housing. Pivot the pick toward the terminal body to release the latch if necessary.
6. Repeat to remove remaining socket terminal.

NOTE

The battery positive cable and power wire for the main fuse are crimped together at the starter ring terminal. Both must be replaced as an assembly if either requires replacement.

Installing Socket Terminals

1. See Figure A-13. Carefully bend tang outward away from the terminal body.
2. Properly orient terminal to the cavity in the housing and push terminal into connector housing until it clicks in place. Verify that socket will not back out of chamber.
3. Push rubber seal into connector housing.
4. Repeat to install remaining socket terminal.
5. Install secondary lock onto connector housing. be sure slots engage tabs on sides of connector housing.
6. Install fuse connector housing in left-side caddy and install caddy. See 7.7 ELECTRICAL CADDIES.
7. Connect battery cables. See 1.17 BATTERY MAINTENANCE.



1. **Secondary lock slot**
2. **Secondary lock**
3. **Tab**
4. **Insert flat blade into opening**

Figure A-12. Delphi Main Fuse Housing: Remove Socket Terminals

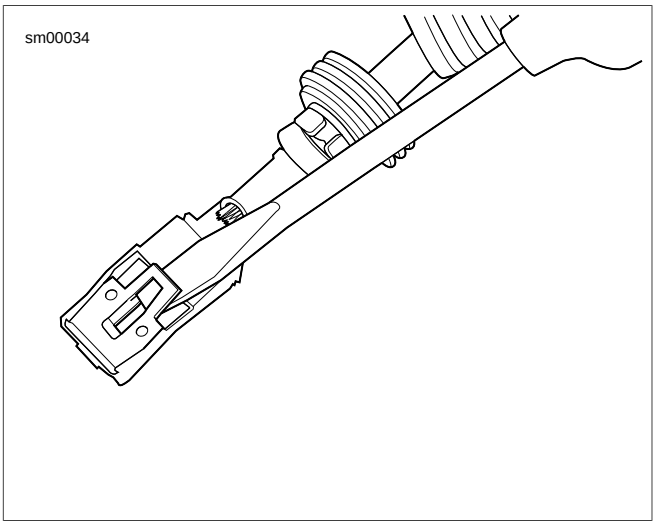


Figure A-13. Delphi Main Fuse Housing: Bend Tang

DEUTSCH ELECTRICAL CONNECTORS A.5

DEUTSCH CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41475	DEUTSCH CONNECTOR SERVICE KIT
HD-41475-100	FLAT BLADE L-HOOK

General

Deutsch connectors are colored coded for location purposes. Those connectors associated with **left** side accessories, such as the front and rear **left** turn signals, are **gray**. All other connectors, including those associated with right side accessories, are **black**.

NOTE

A DEUTSCH CONNECTOR SERVICE KIT (Part No. HD-41475) contains a selection of wire seals, internal seals, seal plugs, secondary locking wedges, attachment clips and socket/pin terminals. Also included is a compartmented storage box, carrying case and a FLAT BLADE L-HOOK (Part No. HD-41475-100) is used for the removal of all types of locking wedges.

Separating Pin and Socket Housings

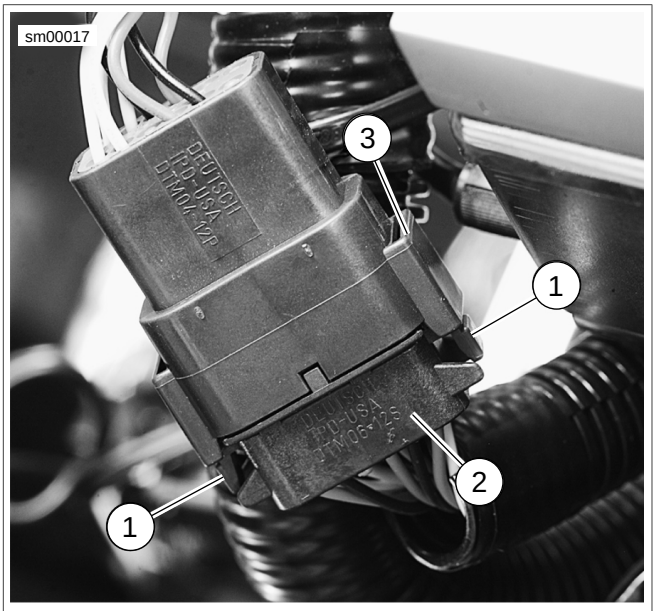
See Figure A-14. To separate the connector halves, depress the external latch(es) (1) on the socket housing (2) while rocking the pin (3) and socket housings.

NOTES

- *Generally, the socket housing is found on the accessory side, while the pin housing is plumbed to the wiring harness.*
- *Two-, three-, four- and six-place Deutsch connectors have one latch on the connector.*
- *Eight- and twelve-place connectors have a latch on each side. Simultaneously press both latches to separate the connector.*

Mating Pin and Socket Housings

1. Align the connectors to match the wire lead colors.
 a. **For One External Latch:** Two-, three-, four- and six-place Deutsch connectors have one external latch on the socket half of the connector. To fit the halves of the connector together, the latch on the socket side must be aligned with the latch cover on the pin side.
 b. **For Two External Latches:** (8-place and 12-place) Align the tabs on the socket housing with the grooves on the pin housing.
2. Insert socket housing into pin housing until it snaps or clicks into place.
 For Two External Latches: (8-place and 12-place) If latches do not click (latch), press on one side of the connector until that latch engages, then press on the opposite side to engage the other latch.
3. If necessary, fit the attachment clip to the pin housing.
4. Place large end of slot on attachment clip over T-stud on frame. Push assembly forward to engage small end of slot.



1. **External latch**
2. **Socket housing**
3. **Pin housing**

Figure A-14. Deutsch Connector

Removing Socket Terminals

1. See Figure A-15. Insert a small screwdriver between the socket housing and locking wedge in-line with the groove (in-line with the pin holes if the groove is absent). Turn the screwdriver 90 degrees to pop the wedge up and remove the secondary locking wedge.
2. See Figure A-18. Use a pick or small screwdriver to depress terminal latches inside socket housing and back out sockets through holes in rear wire seal.

NOTE

*If wire leads require **new** terminals, see the instructions for crimping terminals.*

Installing Socket Terminals

1. Match wire lead color to connector cavity.
2. See Figure A-17. Fit rear wire seal (1) into back of socket housing (2), if removed.
3. Grasp wire lead (3) approximately 1.0 in. (25.4 mm) behind the socket terminal. Gently push socket through hole in wire seal into its chambers until it "clicks" in place.
4. A tug on the wire will confirm that it is properly locked in place.

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NOTE

Seal plugs (6) are installed through the wire seals of unused chambers. If removed, seal plugs must be replaced to seal the connector.

5. Install internal seal (4) on lip of socket housing, if removed.
6. Insert tapered end of secondary locking wedge (5) into socket housing and press down until it snaps in place. The wedge fits into the center groove within the socket housing and holds the terminal latches tightly closed.

NOTES

- *See Figure A-16. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (1) pointing toward the external latch.*
- *If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the socket housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.*

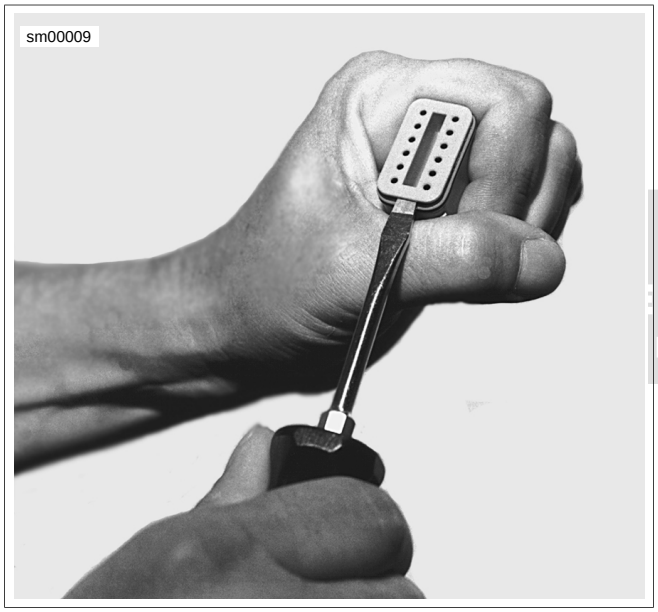
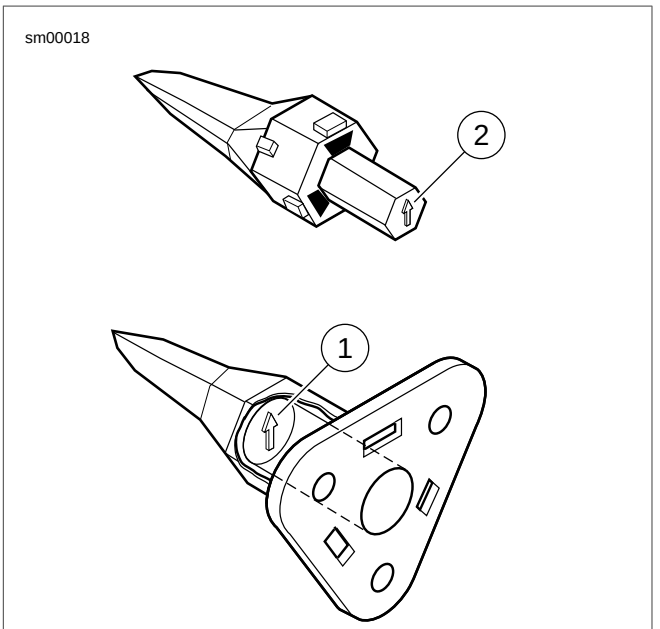


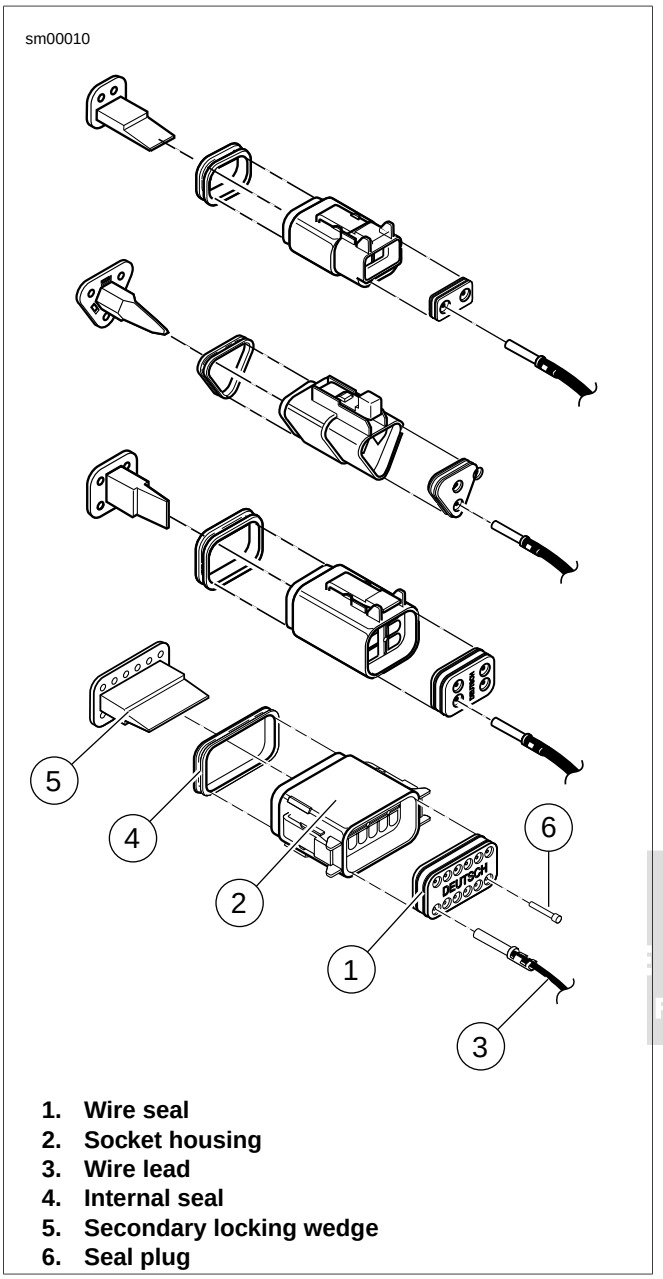
Figure A-15. Deutsch Connector: Remove Secondary Locking Wedge



1. Arrow on socket locking wedge
2. Arrow on pin locking wedge

Figure A-16. Deutsch Connector: 3-Place Locking Wedges

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1. **Wire seal**
2. **Socket housing**
3. **Wire lead**
4. **Internal seal**
5. **Secondary locking wedge**
6. **Seal plug**

Figure A-17. Deutsch Connector: 2, 3, 4 and 12-Place Socket Housings

Removing Pin Terminals

1. Use the hooked end of a stiff piece of mechanics wire, a needle nose pliers or the FLAT BLADE L-HOOK (Part No. HD-41475-100) to remove the secondary locking wedge.
2. Gently depress terminal latches inside pin housing and back out pins through holes in wire seal.

NOTES

- *If wire leads require **new** terminals, see the instructions for crimping terminals.*
- *If it should become necessary to replace a pin or socket housing, please note that the 8-place and 12-place gray and black connectors are not interchangeable. Since location of the alignment tabs differ between the black and gray connectors, plugs or receptacles must be replaced by those of the same color.*
- *When replacing both socket and pin housings, then the black may be substituted for the gray, and vice versa. The socket and pin housings of all other connectors are interchangeable, that is, the black may be mated with the gray, since the alignment tabs are absent and the orientation of the external latch is the same.*

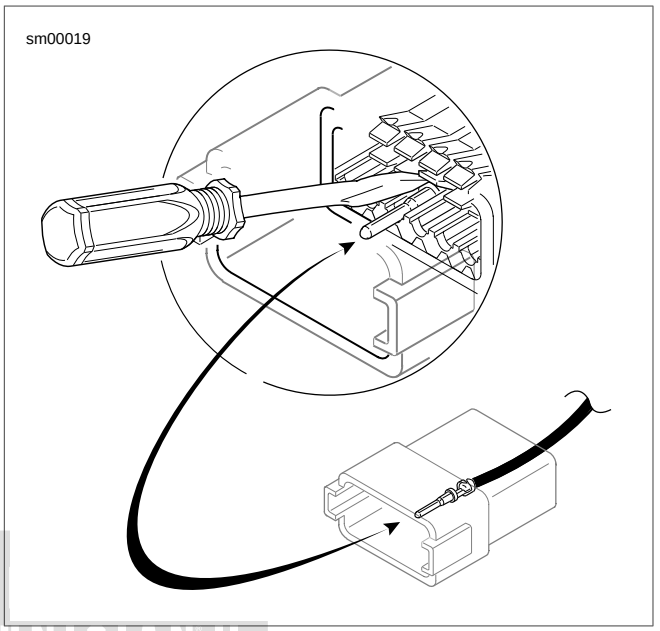


Figure A-18. Deutsch Connector: Depress Terminal Latch and Back Out Pin

Installing Pin Terminals

1. See Figure A-19. Fit wire seal (1) into back of pin housing (2).
2. Grasp wire lead approximately 1.0 in. (25.4 mm) behind the pin terminal (3). Gently push pin through holes in wire seal into its respective numbered chamber until it "clicks" in place.

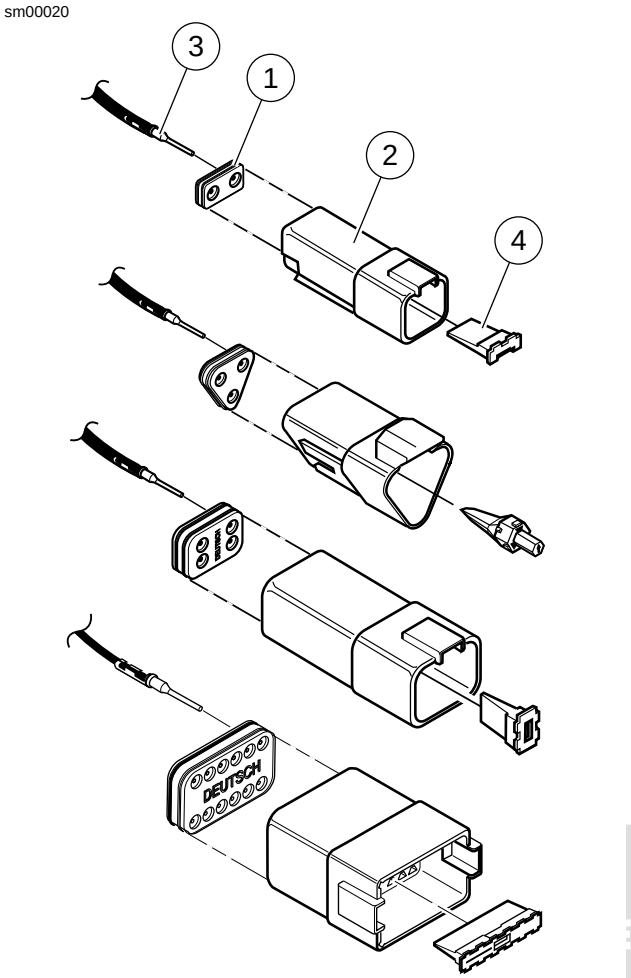
NOTE

A tug on the wire lead will confirm that a pin is locked in place.

3. Insert tapered end of secondary locking wedge (4) into pin housing and press down until it snaps in place.

NOTES

- *The wedge fits in the center groove of the pin housing and holds the terminal latches tightly closed.*
- *See Figure A-16. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (2) pointing toward the external latch.*
- *If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the pin housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.*



1. **Wire seal**
2. **Pin housing**
3. **Pin terminal**
4. **Locking wedge**

Figure A-19. Deutsch Connector: 2, 3, 4 and 12-Place Pin Housings

Crimping Terminals

Identify which of the types of Deutsch terminals are used with the connector and follow the corresponding crimping instructions. Refer to Table A-2.

Table A-2. Deutsch Connector: Terminal Crimping Instructions

TYPE	CRIMPING INSTRUCTIONS
Standard (with crimp tails)	A.6 DEUTSCH STANDARD TERMINAL REPAIR
Mini Terminal (solid barrel)	A.7 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR
Mini Terminal (with crimp tails)	A.8 DEUTSCH MINI TERMINAL REPAIR

DEUTSCH STANDARD TERMINAL REPAIR A.6

DEUTSCH STANDARD TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL

Preparing Wire Leads for Crimping

1. Use a shop gauge to determine gauge of wire lead.
2. Strip lead removing 5/32 in. (4.0 mm) of insulation.

Crimping Terminal to Lead

1. See Figure A-20. Squeeze the handles of the DEUTSCH TERMINAL CRIMP TOOL (Part No. HD-39965-A) to open the jaws. Push the locking bar (1) up.
2. Insert (2) terminal (socket/pin) through hole of the locking bar, so that the rounded side of the contact barrel rests in the nest (concave split level area) with the crimp tails facing upward. To match the wire gauge to the crimp tool die, refer to Table A-3.
3. Release locking bar to lock terminal in die.

NOTE

If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the terminal so that the tails face straight upward. When positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.

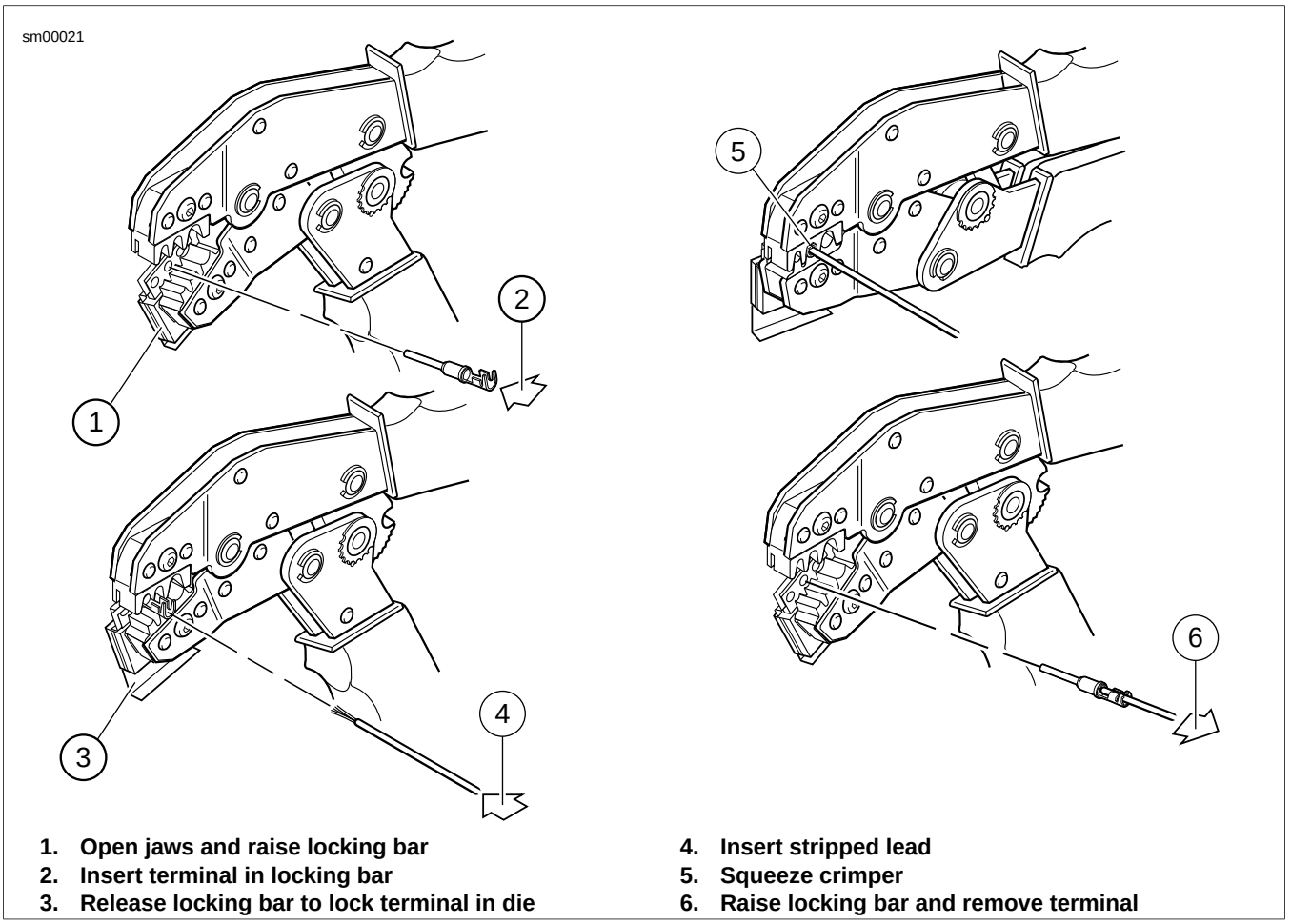
4. Insert stripped wire core between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over the insulation.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens after the terminal is crimped.
6. Raise locking bar up and remove wire lead and terminal.

Inspecting Crimps

Inspect the wire core and insulation crimps. Distortion should be minimal.

Table A-3. Deutsch Standard Terminal Crimp: Wire Gauge To Die

WIRE GAUGE (AWG)	CRIMP TOOL DIE
20	Front
16-18	Middle



1. **Open jaws and raise locking bar**
2. **Insert terminal in locking bar**
3. **Release locking bar to lock terminal in die**
4. **Insert stripped lead**
5. **Squeeze crimper**
6. **Raise locking bar and remove terminal**

Figure A-20. Crimping a Deutsch Standard Terminal

DEUTSCH SOLID BARREL MINI TERMINAL REPAIR A.7

DEUTSCH SOLID BARREL TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-42879	ELECTRICAL CRIMPER TOOL

Preparing Wire Leads For Crimping

For size 20, 16 and 12 contacts, wire ranges 26-12 AWG.

Strip wire lead removing 1/4 in. (6.4 mm) of insulation.

Adjusting Crimper Tool

1. See Figure A-21. Squeeze the ELECTRICAL CRIMPER TOOL (Part No. HD-42879) handles to cycle the crimp tool to open.
2. Remove locking pin (1) from selector knob (2).
3. Raise selector knob and rotate until selected wire size stamped on wheel is aligned with "SEL. NO." arrow (3).
4. Loosen knurled locknut (4) and turn adjusting screw (5) clockwise (in) until it stops.

Crimping a Barrel Contact To Wire Lead

1. See Figure A-22. Turn tool over and drop contact barrel (1) into indentor cover (2) hole with the wire end out.
2. Turn adjusting screw counterclockwise (out) until contact is flush with bottom of depression in indentor cover. Tighten knurled locknut.
3. Slowly squeeze handles of crimp tool until contact is centered between the four indentor points (3).
4. Insert bare wire core strands of stripped wire lead (4) into contact barrel. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
5. Remove wire lead with crimped contact from indentor.

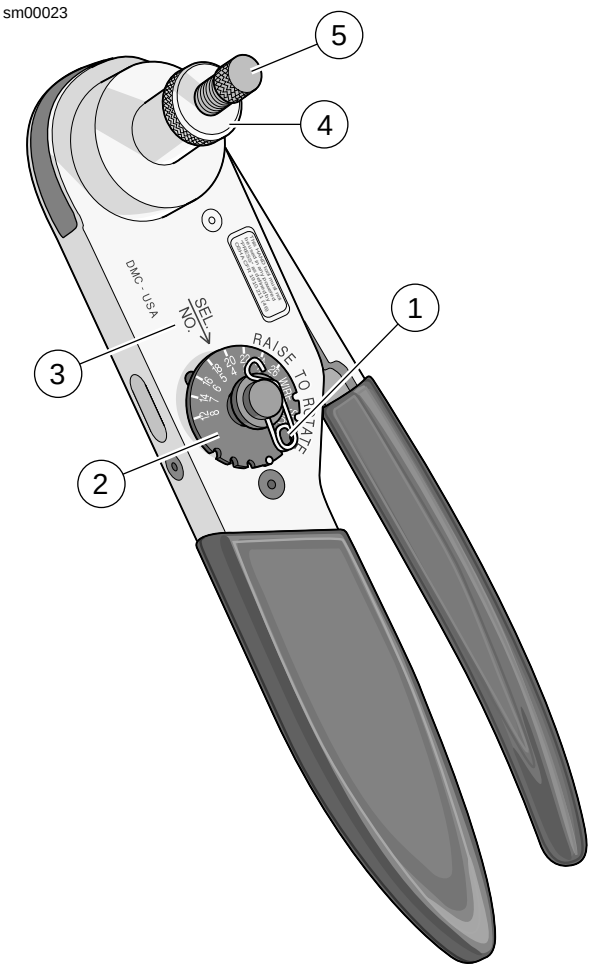
NOTE

Tool must be readjusted when changing contact size/type.

6. Install pin to lock selector knob.

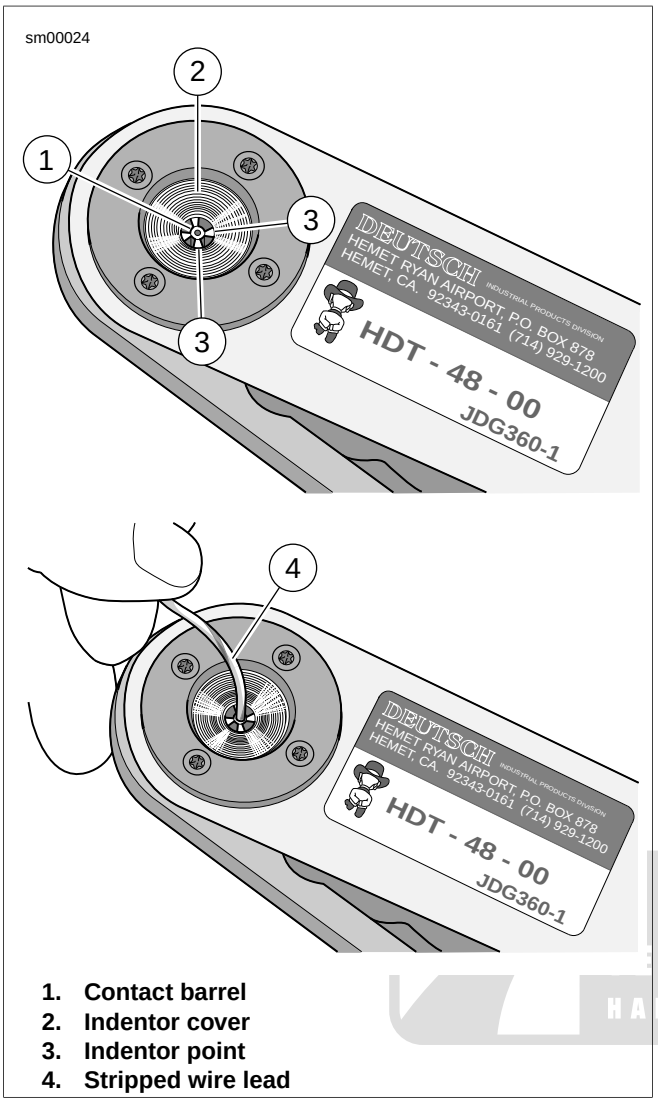
Inspecting Crimps

Inspect the crimp. All core wire strands are to be crimped in the barrel.



1. **Locking pin**
2. **Selector knob**
3. **SEL. NO. arrow**
4. **Knurled locknut**
5. **Adjusting screw**

Figure A-21. Electrical Crimper Tool (HD-42879)



1. **Contact barrel**
2. **Indentor cover**
3. **Indentor point**
4. **Stripped wire lead**

Figure A-22. Deutsch Solid Barrel

IGITAL
CHNICIAN II
HARLEY-DAVIDSON

DEUTSCH MINI TERMINAL REPAIR A.8

DEUTSCH MINI TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-7	PACKARD TERMINAL CRIMPER

Preparing Wire Leads for Crimping

Strip wire lead removing 5/32 in. (4.0 mm) of insulation.

Crimping a Mini Terminal to Wire Lead

1. See Figure A-23. Compress the handles of PACKARD TERMINAL CRIMPER (Part No. HD-38125-7) until the ratchet (2) automatically opens.

NOTE

Always perform core crimp before insulation crimp.

2. Position the core crimp on die E (1) of the crimper. Be sure the core crimp tails are facing the forming jaws.
3. Gently apply pressure to handles of tool until crimpers just secure the core crimp tails.
4. Insert stripped wire core stands between crimp tails. Position wire so that short pair of crimp tails squeeze bare wire strands, while long pair squeeze over the insulation.
5. Squeeze handle of crimper until tightly closed. Tool automatically opens when the crimping sequence is complete.

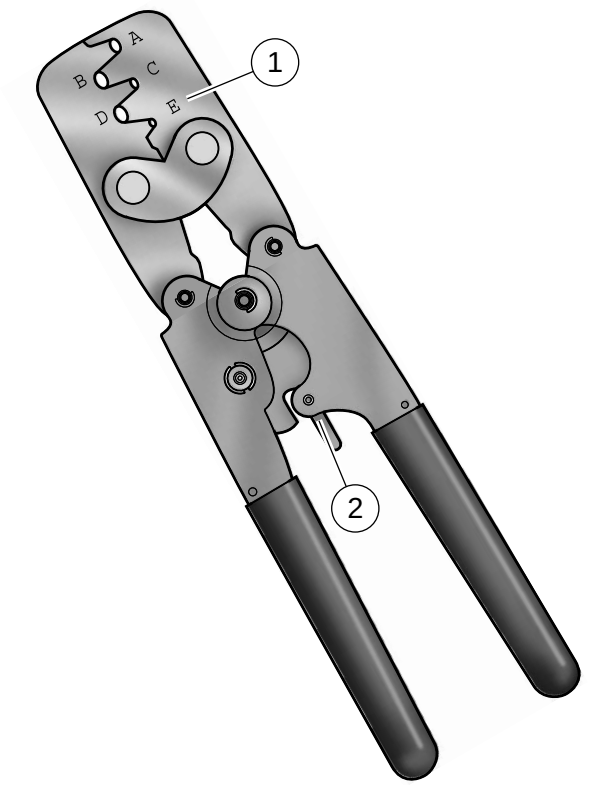
NOTE

If the crimper does not open, it can be opened by squeezing the ratchet trigger (2).

6. Position the insulation crimp on nest C of the crimper. Be sure the insulation crimp tails are facing the forming jaws.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

Inspecting Crimps

Inspect the core and insulation crimps. Distortion should be minimal.



1. E die
2. Crimper ratchet trigger

Figure A-23. Packard Terminal Crimper (HD-38125-7)

MOLEX CONNECTORS A.9

MOLEX CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER

Separating Pin and Socket Housings

See Figure A-24. Depress the latch while pulling the pin and socket housings apart.

Mating Pin and Socket Housings

1. Orient the latch on the pin housing to the latch pocket on the socket housing so the rails on the outside of the pin housings lines up with the tunnels on the socket housing.
2. Press the housings together until the latch clicks.

Removing Terminals

1. Pull the secondary lock up, approximately 3/16 in. (4.8 mm), until it stops.
 a. **Socket Housing:** See Figure A-25. Use a small screwdriver in the pry slot. The slot next to the external latch provides a pivot point.
 b. **Pin Housing:** See Figure A-26. Use needle nose pliers to engage the D-holes in the center of the secondary lock.

NOTE

Do not remove the secondary lock from the connector housing.

2. See Figure A-27. Insert MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER (Part No. HD-48114) into the pin hole next to the terminal until the tool bottoms.
 a. **Socket Housing:** The pin holes are inside the terminal openings.
 b. **Pin Housing:** The pin holes are outside the pins.
3. Pressing the terminal remover to the bottom of the pin hole, gently pull on the wire to remove wire terminal from its cavity.

Installing Terminals

1. See Figure A-28. From the wiring diagram, match the wire color to its numbered terminal cavity.

NOTE

Cavity numbers (1) are stamped on the housing at the ends of the cavity rows. The cavity number can be determined by counting the cavities up or down along the row from each stamped number.

2. Orient the terminal so that the tang (2) opposite the open crimp engages the slot (3) in the cavity.
3. Push the terminal into the cavity.
4. Gently tug on wire to verify that the terminal is captured by the secondary lock.
5. With all terminals installed, push the secondary lock into the socket housing to lock the wire terminals into the housing.

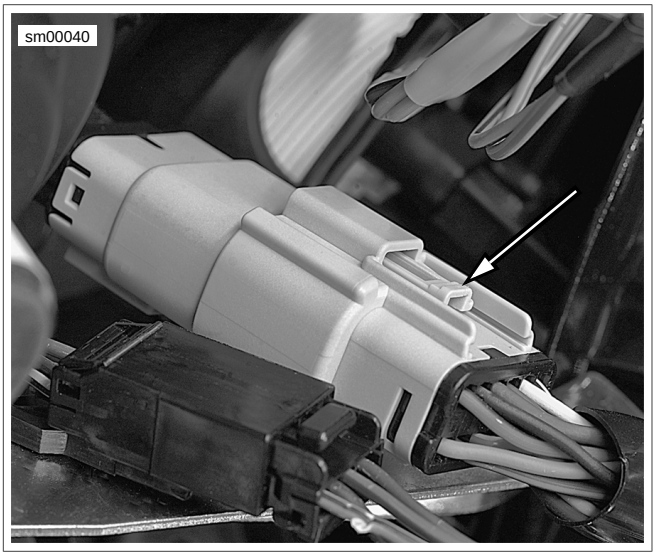


Figure A-24. Molex Connector: Latch

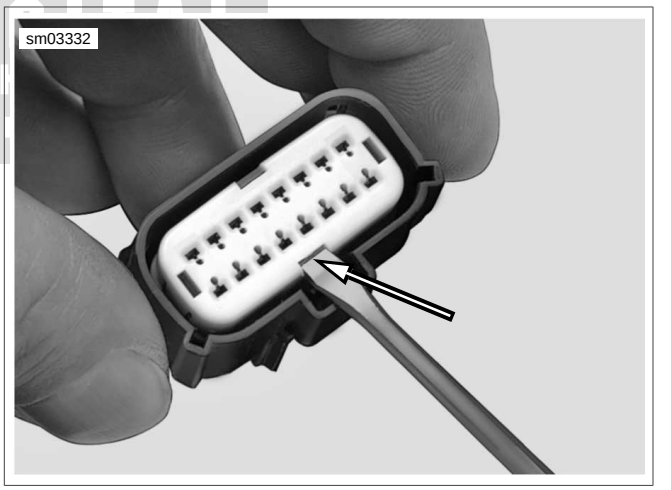


Figure A-25. Secondary Lock Pry Slot (Socket Housing)

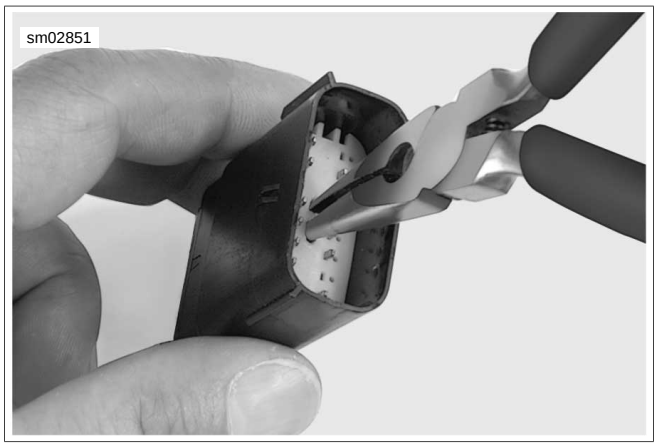
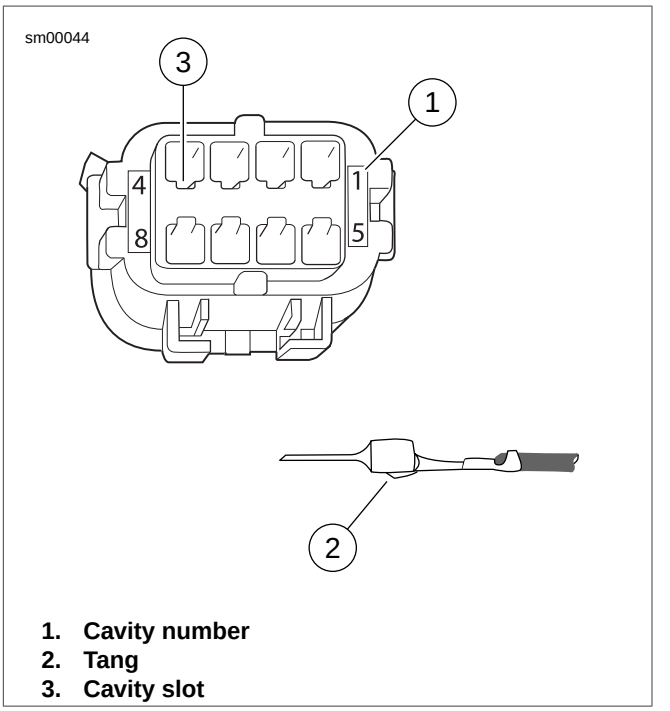


Figure A-26. Pull Up Secondary Lock (Pin Housing)



Figure A-27. Molex Connector: Terminal Remover (HD-48114)



1. **Cavity number**
2. **Tang**
3. **Cavity slot**

Figure A-28. Molex Connector: Pin Cavities and Wire Terminal

CRIMP TERMINAL TO LEAD

PART NUMBER	TOOL NAME
HD-48119	ELECTRICAL CRIMP TOOL

Prepare Lead

1. Cut the damaged terminal close to the back of the terminal to leave as much wire length as possible.
2. Strip approximately 3/16 in. (4.70-5.60 mm) of insulation from the end of the wire lead.

NOTE

The strip length is the same for both pin and socket terminals and for wire gauges from 22 to 14.

Prepare Tool

1. Identify the punch/die in the jaws of the ELECTRICAL CRIMP TOOL (Part No. HD-48119) for the wire gauge. Refer to Table A-4.
2. Squeeze and release the handles to open the tool.

NOTE

The crimp tool automatically opens when the handles are released.

3. See Figure A-29. Hold fully open tool at approximately 45 degrees.

NOTE

Do NOT tighten the locknut holding the locator bars. The bars must float to accommodate the different terminal gauges.

Table A-4. Crimp Tool Wire Gauge Punch/Die

AWG (WIRE GAUGE)	PUNCH/DIE
22	Left
18-20	Middle
14-16*	Right
* Crimp 16 AWG **pin** terminals in the 18-20 middle die.	

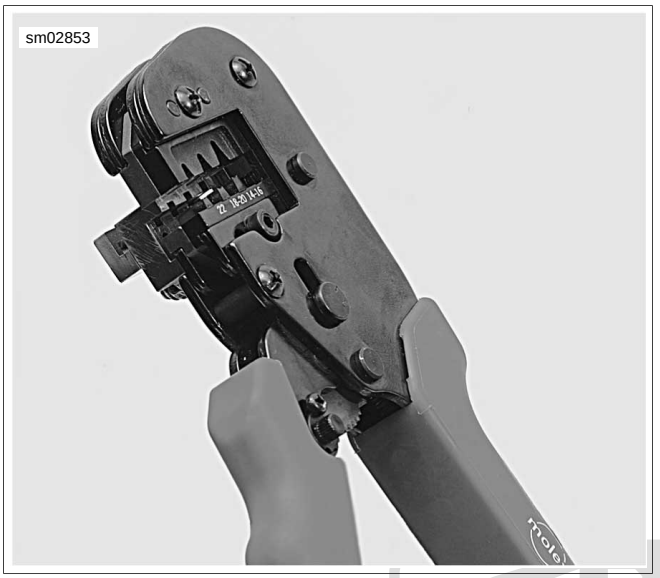
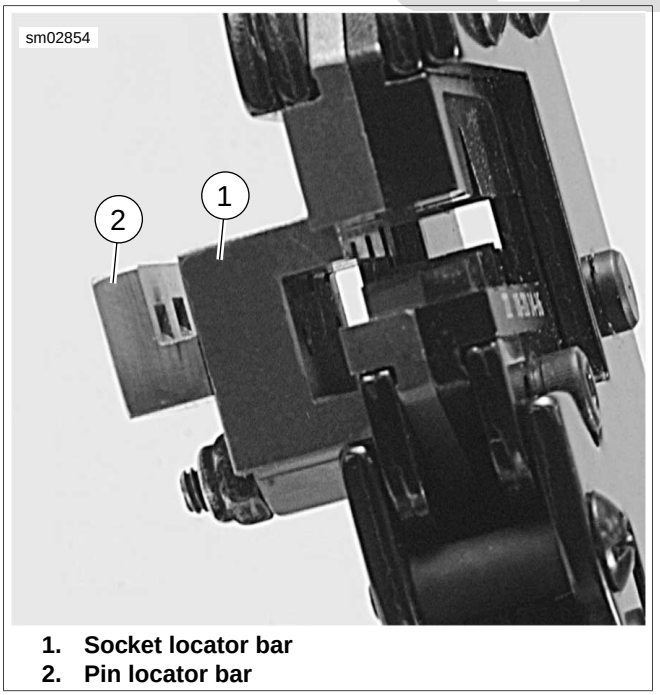


Figure A-29. Open Electrical Crimp Tool (HD-48119) at 45 Degrees



1. **Socket locator bar**
2. **Pin locator bar**

Figure A-30. Terminal Locator Bars

Position Terminal in the Punch/Die

1. See Figure A-31. With the crimp tails up, place the terminal through the punch/die into the square opening in the socket locator bar.
 a. **Socket Terminal:** See Figure A-30. A socket terminal stops against the back face of the socket locator bar (1).
 b. **Pin Terminal:** See Figure A-32. The tip of a pin terminal passes through the socket locator bar and stops in the notch in the face of the pin locator bar.
2. See Figure A-33. Ratchet the handles together until the crimp tails are held in vertical alignment between the punch and the die.

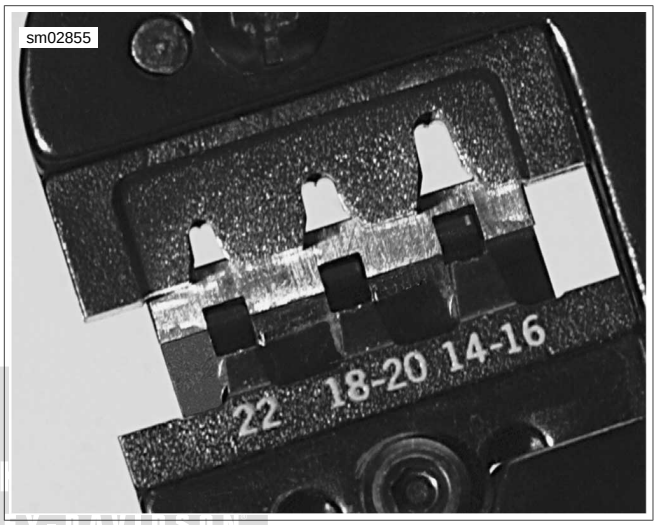


Figure A-31. Square Openings in Socket Locator Bar

Insert Stripped Lead

See Figure A-34. Insert the stripped end (wire core) between the crimp tails at an up angle until the wire core touches the face of the socket locator bar above the square opening.

NOTES

- *The insulation must extend through the insulation crimp tails.*
- *Insert the wire with little or no pressure. Pressing on the lead will bend the wire core.*

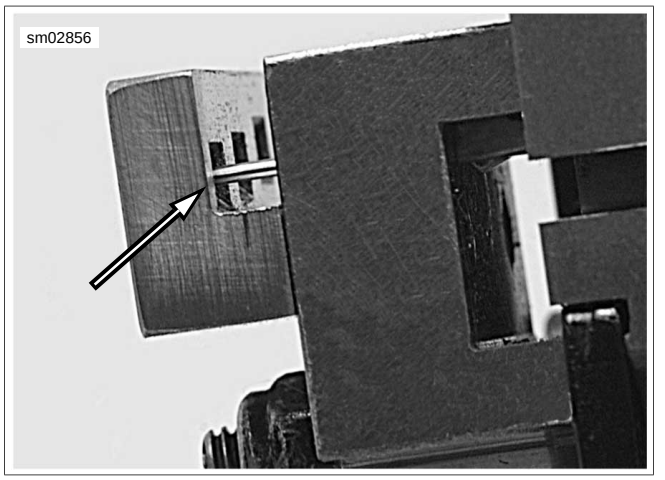


Figure A-32. Pin Terminal against Pin Locator Bar

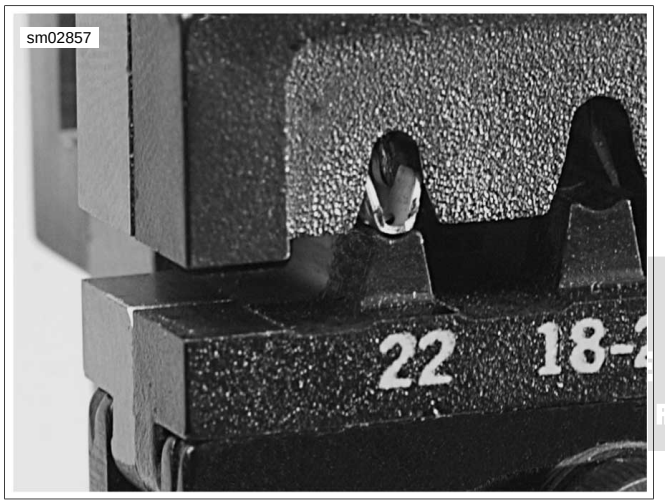


Figure A-33. Crimp Tails in Vertical Alignment between Punch and Die

Crimp Terminal to Lead

1. Holding the wire lead in position touching the locator face at an angle, quickly and smoothly squeeze the crimp tool closed.
2. Final squeeze the handles to open the tool and release the terminal.

NOTE

*A stuck or jammed tool can be opened by pressing the ratchet release lever found between the handles. Do **not** force the handles open or closed.*

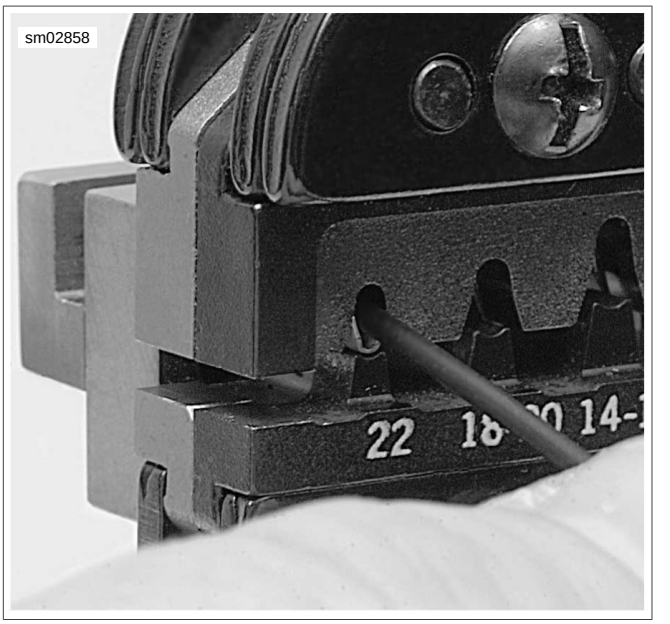
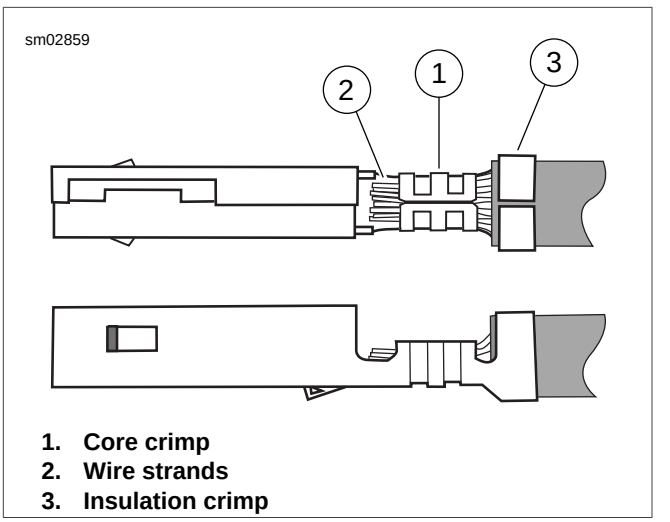


Figure A-34. Stripped Lead at Up Angle

Inspect Crimp

1. **Inspect Crimp:** Inspect the core and insulation crimp.
 a. See Figure A-35. The core tails should be creased into the wire strands at the core crimp (1).
 b. Strands (2) of wire should be visible beyond the core crimp but not forward into the terminal shell.
 c. The insulation tails should be folded into the insulation (3) without piercing or cutting the insulation.
 d. Distortion should be minimal.
2. **Test Crimp:** Hold the terminal and pull the lead.



1. **Core crimp**
2. **Wire strands**
3. **Insulation crimp**

Figure A-35. Terminal Crimp

PACKARD 150 METRI-PACK CONNECTORS A.10

150 METRI-PACK CONNECTOR REPAIR

General

Metri-Pack connectors are embossed with the initials (P.E.D.).

There are two types of connectors in this series:

- Pull-to-Seat
- Push-to-Seat

Separating Pin and Socket Housings

Bend back the external latch slightly and separate the pin and socket halves of the connector.

Mating Pin and Socket Housings

Align the wire colors and push the pin and socket halves of the connector together.

Removing Socket Terminal

1. See Figure A-36 for pull-to-seat connector or Figure A-37 for push to seat connector. Remove wire lock (1) from wire end of socket housing on push-to-seat type connectors.

NOTE

For best results, free one side of wire lock first and then release the other side.

2. Find the locking tang in the mating end of the connector.

NOTE

The tangs are always positioned in the middle of the chamber and are on the same side as the external latch.

3. Gently insert a safety pin into the chamber about 1/8 in. (3.2 mm).
 a. **For pull-to-seat:** Stay between the terminal and the chamber wall and pivot the end of the pin toward the terminal body.
 b. **For push-to-seat:** There is a small opening for the pin.
4. When a click is heard, remove the pin and repeat the procedure.

NOTE

The click is the sound of the tang returning to the locked position as it slips from the point of the pin.

5. Pick at the tang until the clicking stops and the pin seems to slide in deeper than it had previously. This is an indication that the tang has been depressed.

NOTE

On those terminals that have been extracted on multiple occasions, the click may not be heard, but pivot the pin as if the click was heard at least 3 times.

6. Remove the pin.
 a. **For pull-to-seat:** Push on the lead to extract the terminal from the mating end of the connector.
 b. **For push-to-seat:** Pull on the lead to draw the terminal out the wire end.

Inserting Socket Terminal

NOTE

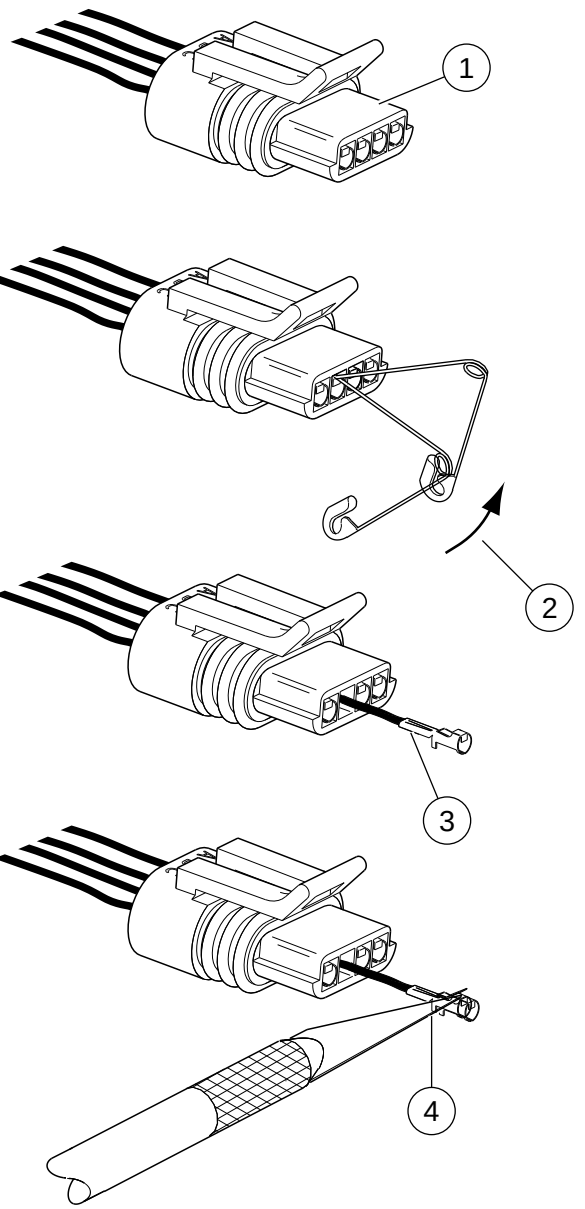
For wire location purposes, alpha characters are stamped into the socket housings.

1. See Figure A-36 for pull-to-seat connector or Figure A-37 for push to seat connector. Using a thin flat blade, like that on a hobby knife, carefully bend the tang outward away from the terminal body.
2. Gently pull or push on the lead to install the terminal back into the chamber. A click is heard when the terminal is properly seated.
3. Gently pull or push on the lead to verify that the terminal is locked in place.

 For push-to-seat: See Figure A-37. Seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

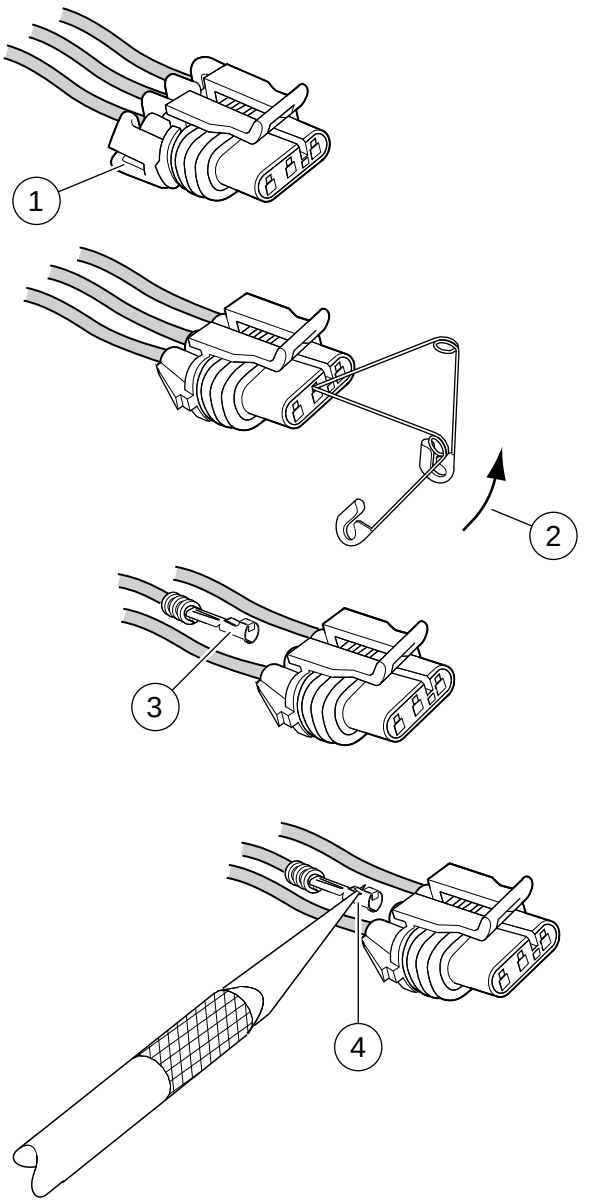
sm00027



1. Locate tang in chamber
2. Pivot pin to depress tang
3. Push to remove
4. Raise tang to install

Figure A-36. 150 Metri-Pack Connector: Pull-to-Seat

sm00028



1. Remove wire lock
2. Pivot pin to depress tang
3. Pull to remove
4. Raise tang to install

Figure A-37. 150 Metri-Pack Connector: Push-to-Seat

PACKARD 280 METRI-PACK RELAY AND FUSE BLOCK CONNECTORS A.11

FUSE BLOCK REPAIR

Removing Socket Terminals

1. See Figure A-38. To remove secondary locks, insert end of small flat blade screwdriver (1) under lip of locking wedge (2) and gently pry up secondary lock.

NOTE

For best results, start with locking wedge on outboard side of secondary lock.

2. Looking into chamber at top of fuse block, note the tang next to each socket terminal.
3. Using a thin flat blade, like that on a hobby knife, gently push tang away from terminal, and then tug on wire to back terminal out.

Installing Socket Terminals

1. Match the wire lead color to the fuse block terminal cavity.

NOTES

- *Refer to the main harness wiring diagram for wire lead color codes.*
- *See Figure A-39. The main fuse block terminal cavity is identified as alpha (1) and numeric (2) coordinates. Refer to the main harness wiring diagram for fuse block terminal cavity coordinates.*

2. With the open side of the socket terminal facing the tang, push lead into chamber at the wire end of the fuse block. A click is heard when the terminal is properly engaged.
3. Gently tug on the wire to verify that the terminal is locked in place and will not back out of the chamber.
4. Install the secondary locks. With the locking wedges positioned above the tangs in each chamber, slide flat side of secondary lock into slot (between rows), and push down until it bottoms.

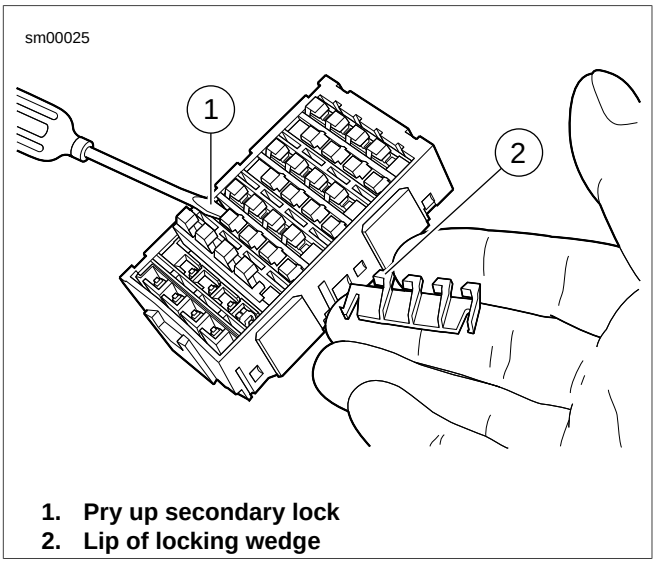
Crimping Terminals

Terminals are crimped twice; once over the wire core and a second time over the insulation/seal.

A correctly crimped terminal may require different crimping dies found on separate crimpers.

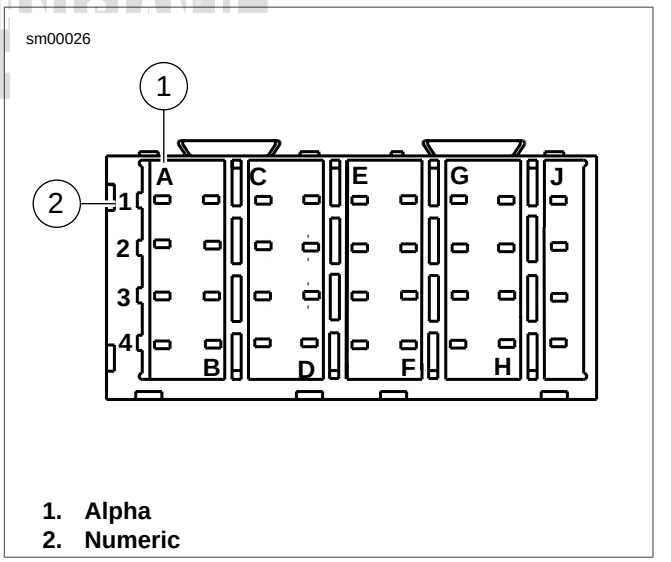
NOTE

The wiring diagram indicates when one socket terminal is be crimped to two wire leads.



1. Pry up secondary lock
2. Lip of locking wedge

Figure A-38. Fuse Block: Remove Secondary Locks



1. Alpha
2. Numeric

Figure A-39. Fuse Block: Coordinates (typical)

PACKARD 480 METRI-PACK CONNECTORS A.12

480 METRI-PACK CONNECTOR REPAIR

General

A 480 Metri-Pack (P.E.D.) connector is frequently used for the B+ (battery voltage) connector to power P&A accessories.

Referred to as Packard connectors, Metri-Pack connectors are embossed with the initials P.E.D.

See Figure A-40. An AFL housing (5) is used on many ignition/light switches. The secondary lock (4) must be opened before removing the terminal from the housing.

Separating Pin and Socket Housings

NOTE

Cut any cable strap anchoring the wire conduits of the pin (accessory connector housing) and the socket (B+) housing.

See Figure A-40. Using small flat blade screwdriver, press button (1) on pin housing (red wire) side of the connector and pull apart the pin and socket housings.

Mating Pin and Socket Housings

Orient the latch on the socket housing to the button catch on the pin housing and press the housings together.

Removing Socket Terminals

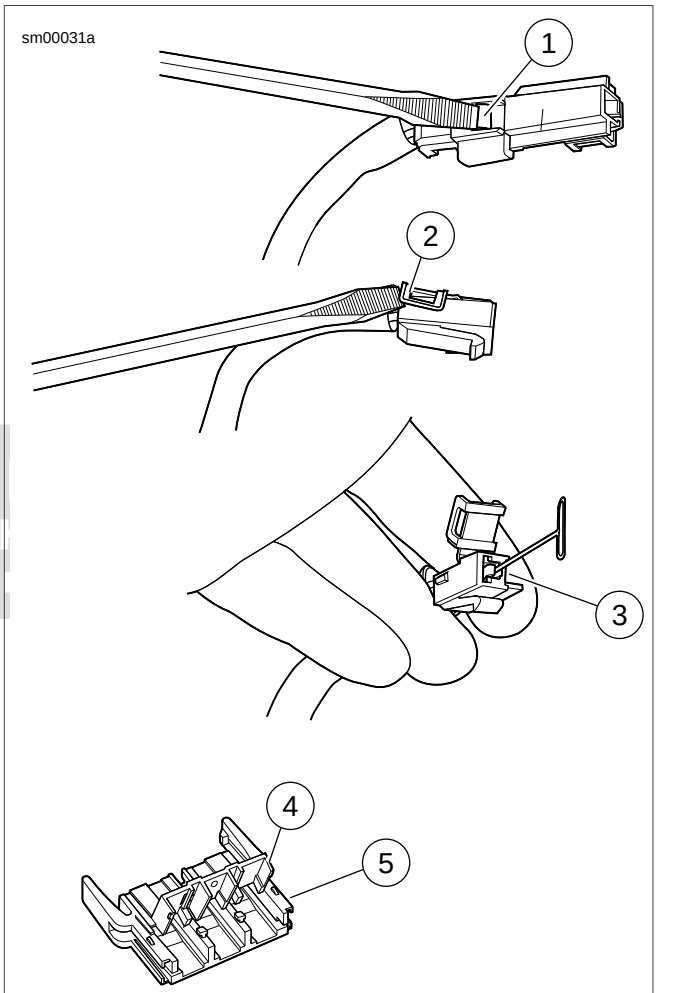
1. See Figure A-40. Bend back the latch (2) slightly and free one side of secondary lock, then repeat to release the opposite side. Rotate the secondary lock outward on hinge to access terminal in chamber of connector housing.
2. On the mating end of the connector, note the tang in the square shaped opening centered next to the terminal. Gently insert the point of a stick pin or large safety pin into the opening (3) between the tang and the chamber wall until it stops.
3. Pivot the end of the pin toward the terminal body to press the tang.
4. Remove the pin and then pull terminal out of the wire end of connector housing.
5. If necessary, crimp **new** terminals on wires. See A.14 PACKARD METRI-PACK TERMINALS.

Installing Socket Terminals

1. Carefully bend the tang outward away from the terminal body.
2. With the tang on the same side as the square shaped opening in the mating end of the connector housing, feed terminal into wire end of connector housing until it "clicks" in place.
3. Verify that terminal will not back out of the chamber. A slight tug on the cable will confirm that it is locked.
4. Rotate the hinged secondary lock inward until latches fully engage tabs on both sides of connector housing.

NOTE

*If removed, install **new** anchored cable strap in O.E. location. Tighten cable strap to capture conduit of both accessory connector and B+ connector approximately 1.0 in. (25.4 mm) from housings.*



1. **Button on pin housing**
2. **Secondary lock latch**
3. **Opening between tang and chamber wall**
4. **Secondary Lock (shown open)**
5. **AFL housing**

Figure A-40. 480 Metri-Pack Connector: Remove Socket Terminal

PACKARD 630 METRI-PACK CONNECTORS A.13

630 METRI-PACK CONNECTOR REPAIR

PART NUMBER	TOOL NAME
SNAP-ON TT600-3	SNAP-ON PICK

General

Referred to as Packard connectors, Metri-Pack 630 series connectors are embossed with the initials P.E.D.

Separating Pin and Socket Housings

NOTE

If necessary, remove connector from barbed anchor or other retaining device.

Bend back the external latch slightly and separate pin and socket halves of the connector.

Mating Pin and Socket Housings

Orient the latch to the catch and push the pin and socket halves of the connector together until the latch "clicks".

NOTE

If removed, install connector on barbed anchor or other OE retaining device.

Removing Socket Terminal

1. Bend back the latch slightly and free one side of the secondary lock. Repeat the step to unlatch the other side.
2. Rotate the secondary lock outward on hinge to view the terminals in the chambers of the connector housing. The locking tang is on the side opposite the crimp tails and engages a rib in the chamber wall to lock the terminal in place.
3. Moving to the mating end of the connector, take note of the small opening on the chamber wall side of each terminal.
4. Insert SNAP-ON PICK (Part No. SNAP-ON TT600-3) into opening until it stops. Pivot the end of the pick toward the terminal to depress the locking tang.
5. Remove the pick and gently tug on the wire to pull the terminal from the wire end of the connector. Repeat steps if the terminal is still locked in place.
6. If necessary, crimp **new** terminals on wires. Refer to A.14 PACKARD METRI-PACK TERMINALS.

Installing Socket Terminal

NOTE

Refer to the wiring diagrams to match wire lead colors to alpha characters molded into the secondary locks of each connector housing.

1. Using a thin flat blade, like that of a hobby knife, carefully bend the tang outward away from the terminal body.
2. With the tang facing the chamber wall, push the lead into the chamber at the wire end of the connector. A click is heard when the terminal is properly seated.
3. Gently tug on the wire end to verify that the terminal is locked in place and will not back out of the chamber.
4. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.

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PACKARD METRI-PACK TERMINALS A.14

METRI-PACK TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-6	PACKARD TERMINAL CRIMP TOOL
HD-38125-7	PACKARD TERMINAL CRIMPER
HD-38125-8	PACKARD CRIMPING TOOL

Matching Terminal To Crimper

Metri-Pack connectors embossed with the initials P.E.D. require Packard crimp tools to crimp terminals to wire leads.

Terminals are crimped twice to a wire lead, once over the wire core and a second time over the insulation/seal.

See Figure A-41. A completed crimp may require two different crimping dies found on PACKARD TERMINAL CRIMP TOOL (Part No. HD-38125-6) and/or PACKARD TERMINAL CRIMPER (Part No. HD-38125-7). The terminal (pin or socket) and the wire lead gauge will determine the core crimp die and the insulator/seal die.

NOTE

The PACKARD CRIMPING TOOL (Part No. HD-38125-8) will also crimp sealed splice connectors in wire gauge sizes 18-20, 14-16 and 10-12.

Preparing Wire Lead

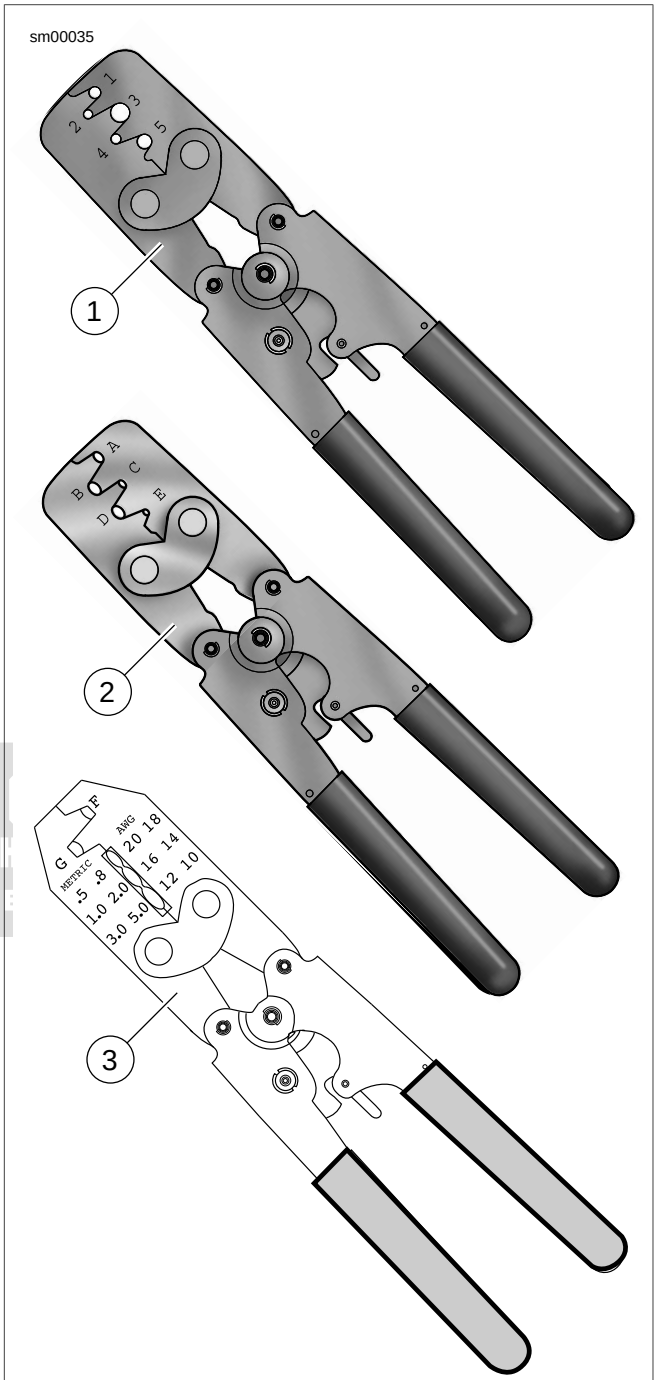
Use a wire striper to strip off the insulation and expose 5/32 in. (4.0 mm) of wire core.

Crimping Wire Core

NOTE

*Metri-Pack terminal crimps require two steps. Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. Squeeze and release handles until ratchet automatically opens.
2. Identify the corresponding sized nest for the core crimp.
3. Position the core crimp in the die. Be Sure the core crimp tails are facing the forming jaws.
4. Gently squeeze the handles until crimpers just secure the core crimp tails.
5. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze core wire strands, while long pair is positioned over the insulation or seal material.
6. Squeeze handles tightly closed. Release grip and the tool will automatically open.



1. **HD-38125-6 sealed terminals**
2. **HD-38125-7 non-sealed terminals**
3. **HD-38125-8 non-sealed terminals**

Figure A-41. Metri-Pack Terminal Crimp Tools

Crimping Insulation/Seal

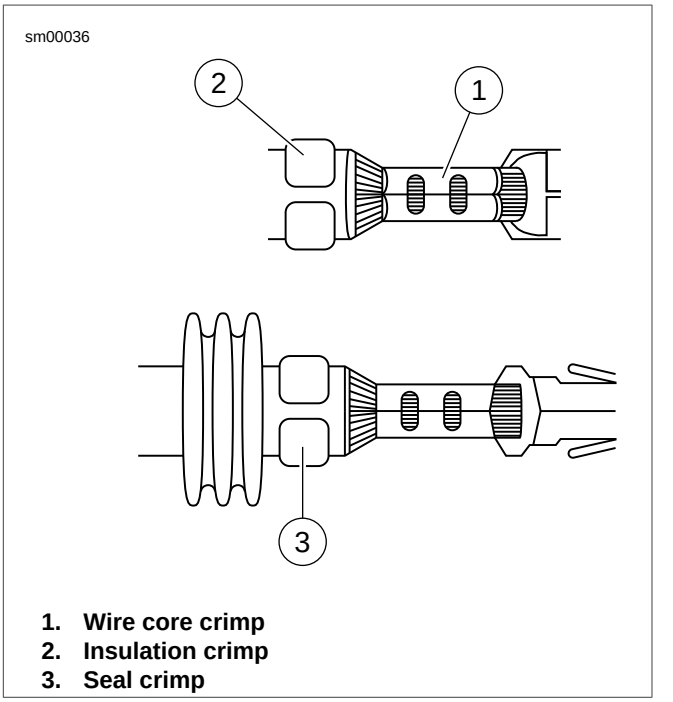
NOTE

*Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. See Figure A-42. Identify the correct die for the insulation/seal crimp (2).
2. Position the insulation/seal crimp in the nest. Be sure the insulation/seal crimp tails are facing the forming jaws.
3. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimp is complete.

Inspecting Crimps

1. See Figure A-42. Inspect the wire core crimp (1). The tails should be folded in on the wire core without any distortion or excess wire strands.
2. Inspect the insulation (2) or seal (3) crimp. The tails of the terminal should be wrapped around the insulation without distortion.



1. **Wire core crimp**
2. **Insulation crimp**
3. **Seal crimp**

Figure A-42. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

ECM CONNECTOR A.15

DELPHI 73-TERMINAL ECM CONNECTOR

NOTE

Do not operate latch lever when connector is not mated to ECU. Damage will occur.

Separating Socket Housing From ECM

NOTE

Although this procedure shows the ECM removed, the ECM connector can be removed and installed with the ECM removed or in place.

See Figure A-43. While pressing latch (1), rotate lock lever to the released position (2).

Mating Socket Housing To ECM

Push the connector into the ECM and rotate lock lever to the locked position.

Socket Terminal

1. Cut cable strap to release harness from strain relief collar of connector housing.
2. See Figure A-44. Release latches (4) that retain cover (3) to housing (2) and remove cover.
3. Follow instructions in A.16 PACKARD MICRO-64 CONNECTORS to remove and service the Micro-64 terminals.
4. Install connector housing cover. Verify all wires are within the confines of the cover and that the cover latches are engaged.
5. Install **new** cable strap cable to the strain relief of the connector.

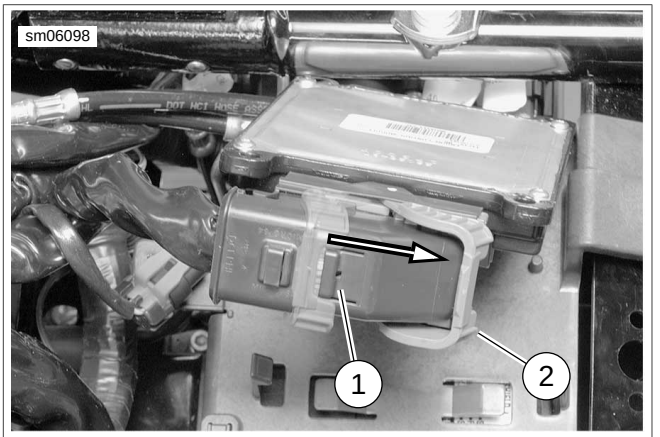
ECM Ground Terminal

1. See Figure A-44. Remove secondary lock (1).
2. See Figure A-45. Using a thin blade screwdriver, gently pry ground terminal retainer from connector housing.
3. See Figure A-46. Using a thin blade screwdriver, release latch and pull ground wire, wire seal and terminal from cover side of housing.
4. Follow instructions in A.14 PACKARD METRI-PACK TERMINALS to replace the terminal or wire seal.
5. Push the terminal into place from the cover side of the connector housing until the latch engages. Pull on wire to verify terminal is secure.

NOTE

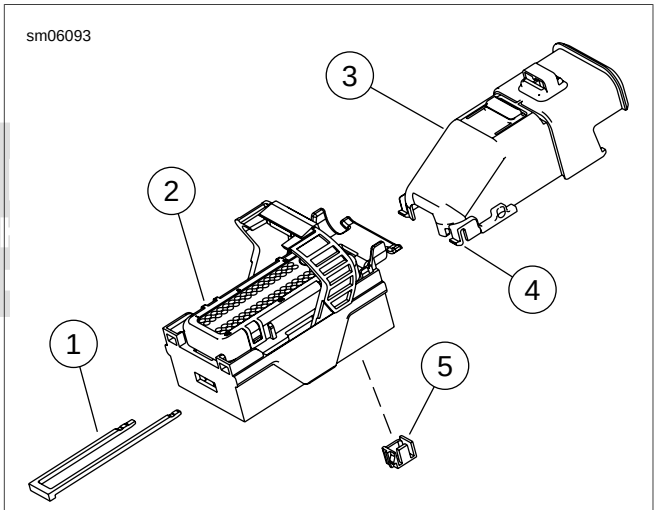
Secondary lock has one short leg and one long leg. Be sure to install correctly as shown in Figure A-44.

6. See Figure A-44. Install ground secondary lock (5) and install secondary lock (1) as shown.



1. **Latch**
2. **Lock lever released**

Figure A-43. Unlatch ECM Connector



1. **Secondary lock**
2. **Terminal housing**
3. **Cover**
4. **Cover latch**
5. **Ground secondary lock**

Figure A-44. Delphi 73-Terminal ECM Connector

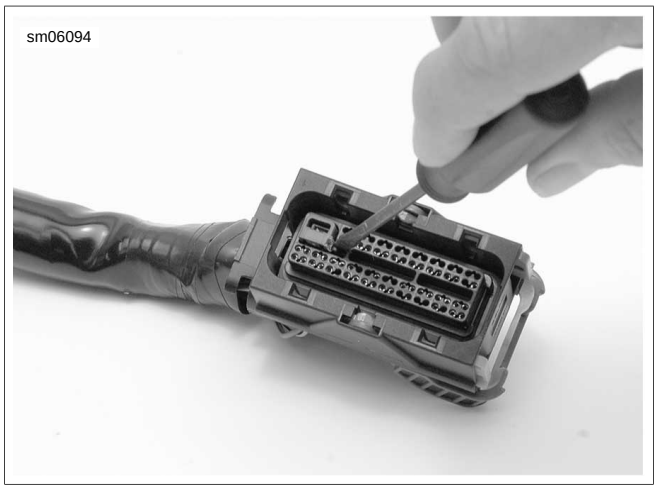


Figure A-45. Remove Ground Secondary Lock

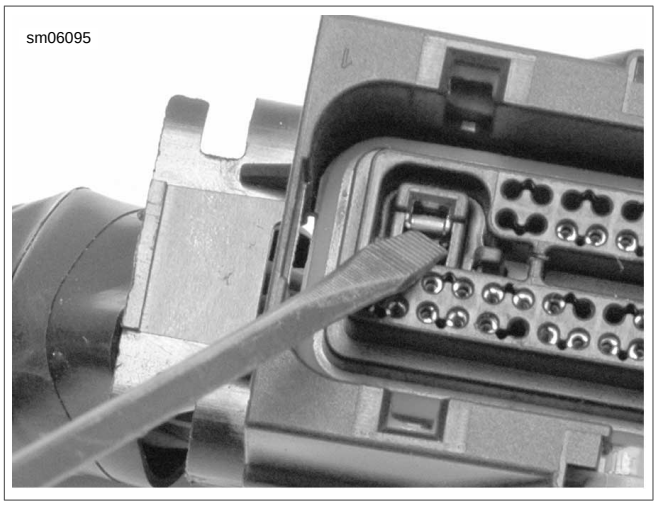


Figure A-46. Remove ECM Ground Terminal

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

PACKARD MICRO-64 CONNECTORS A.16

PACKARD MICRO-64 CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-45928	PACKARD MICRO-64 TERMINAL REMOVER
HD-45929	PACKARD MICRO-64 TERMINAL CRIMPER

General

Packard Micro-64 connectors are frequently found on speedometers, tachometers and the ECM of Touring Models. For pin 73 of these ECMs, see A.10 PACKARD 150 METRI-PACK CONNECTORS.

Separating Pin and Socket Housings

Bend back the external latches slightly and separate the pin and socket housings.

Mating Pin and Socket Housings

Orient the wire lead colors and push the pin and socket housings of the connector together until the latches click.

Removing Terminal

1. See Figure A-49. Locate the head of the secondary lock (1) on one side of the connector housing.
2. Insert the blade of a small screwdriver between the center ear of the lock and the connector housing and gently pry out lock. When partially removed, pull lock from connector housing.
3. Locate pin hole (2) between terminals on mating end of connector.
4. See Figure A-50. Obtain the PACKARD MICRO-64 TERMINAL REMOVER (Part No. HD-45928).
5. See Figure A-48. Push the adjacent terminals all the way into the connector housing and then insert tool into hole until it bottoms.
6. Leaving the tool installed, gently tug on wires to pull either one or both terminals from wire end of connector. Remove tool.

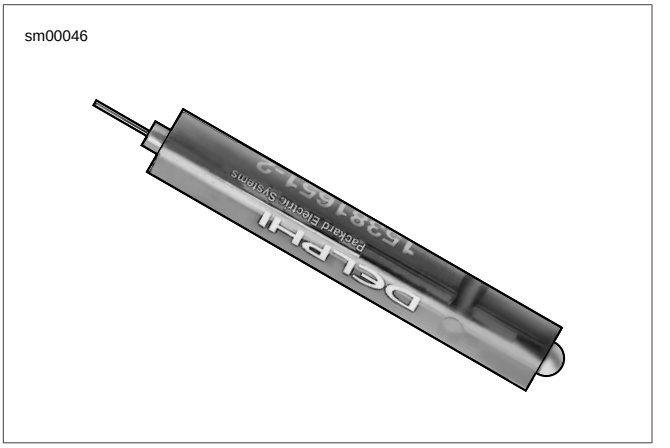


Figure A-47. Packard Micro 64 Terminal Remover (HD-45928)

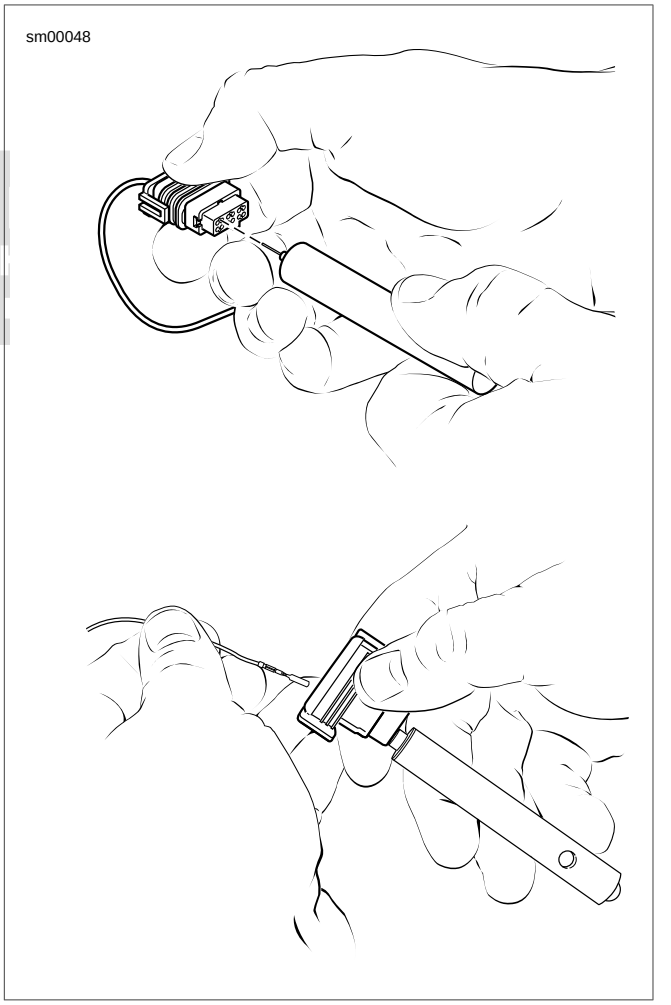


Figure A-48. Packard Micro 64 Connector: Insert Tool and Remove Terminal

Installing Terminal

1. Insert terminal into its respective numbered chamber on wire end of connector. No special orientation of the terminal is necessary.

NOTE

See Figure A-49. For wire location purposes, the corners of the socket housing are stamped (3) with the numbers 1, 6, 7 and 12, representing terminals 1-6 on one side, and 7-12 on the other.

2. Bottom the terminal in the chamber and then gently tug on the wire to verify that it is locked in place.

NOTE

Once the terminal is removed it may not lock in place when first reinstalled. Until the lock engages, move the terminal back and forth slightly while wiggling the lead.

3. Since the terminal remover tool releases two terminals simultaneously, repeat step 2 on the adjacent terminal even if it was not pulled from the connector housing.

4. With the center ear on the head of the secondary lockpin facing the mating end of the connector, push secondary lock in until head is flush with the connector housing.

Preparing Wire Leads for Crimping

Strip lead removing 1/8 in. (3.0 mm) of insulation.

Crimping Terminals

1. Inspect **new** socket terminal for bent or deformed contact and crimp tails. Replace as necessary.

2. See Figure A-51. Squeeze the handles of the PACKARD MICRO-64 TERMINAL CRIMPER (Part No. HD-45929) to cycle the tool to the fully open position (1).

3. Raise locking bar and barrel holder by pushing up on bottom tab with index finger (2).

4. With the crimp tails facing upward, insert terminal through locking bar into front hole in barrel holder (20-22 gauge wire) (3).

5. Release locking bar to lock position of contact. When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails and the closed side of the terminal rests on the outer nest of the crimp tool.

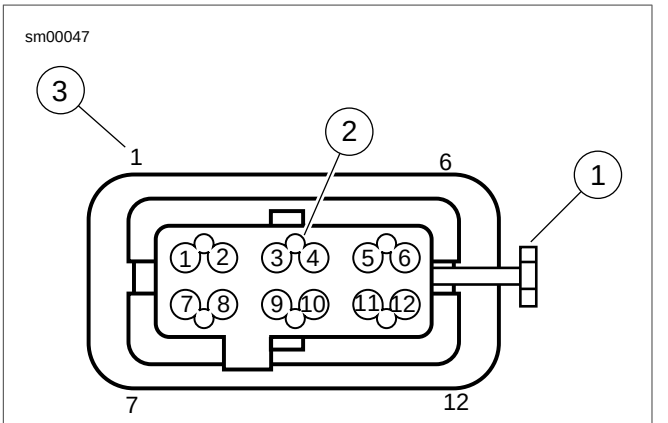
6. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that wide pair of crimp tails squeeze bare wire strands, while the narrow pair folds over the insulation material.

7. Squeeze handle of crimp tool until tightly closed (4). Tool automatically opens when the crimping sequence is complete.

8. Raise locking bar and barrel holder to remove contact.

Inspecting Crimps

Inspect the quality of the core and insulation crimps. Distortion should be minimal.



1. **Secondary lock**
2. **Pin hole**
3. **Stamped number**

Figure A-49. Packard Micro 64 Connector: Housing

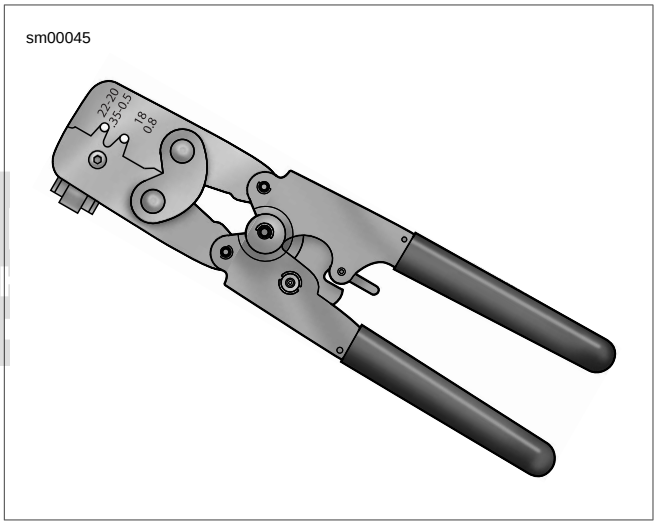
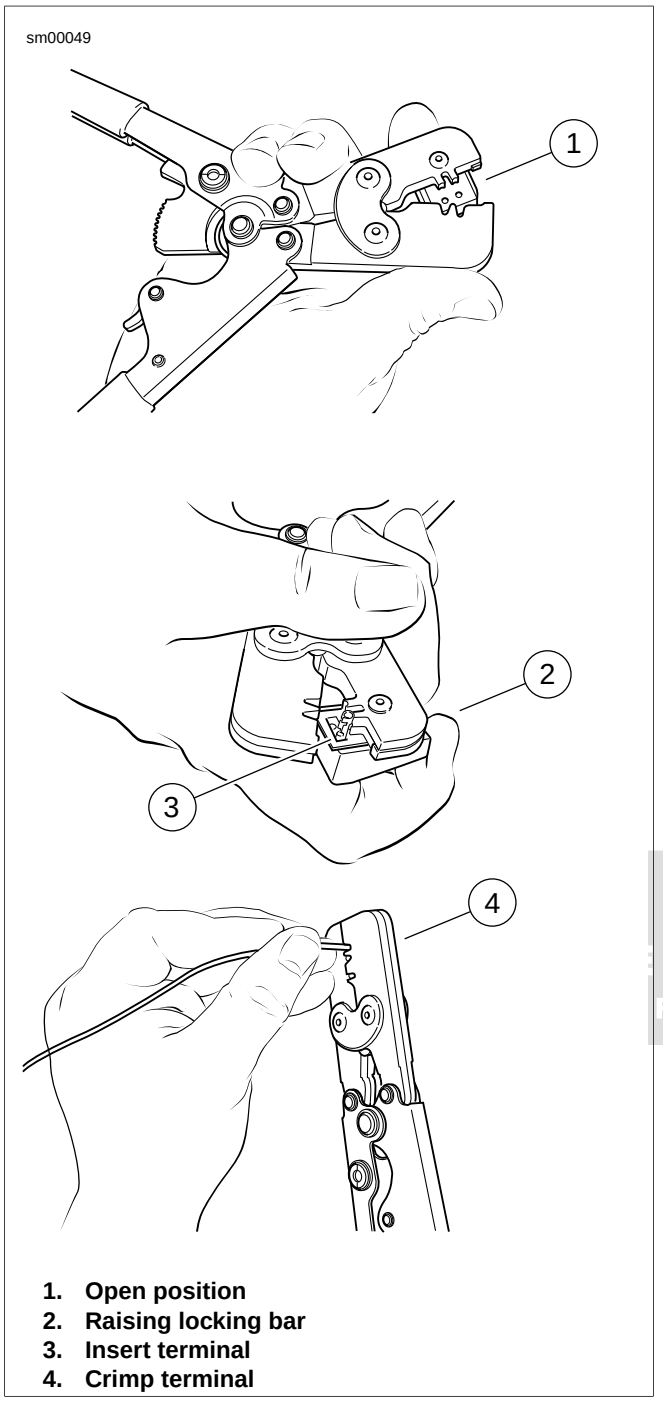


Figure A-50. Packard Micro 64 Terminal Crimper (HD-45929)



1. **Open position**
2. **Raising locking bar**
3. **Insert terminal**
4. **Crimp terminal**

Figure A-51. Packard Micro 64 Connector: Terminal in Crimper

IGITAL
CHNICIAN® II
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SEALED SPLICE CONNECTORS A.17

SEALED SPLICE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-38125-8	PACKARD CRIMPING TOOL
HD-39969	ULTRA TORCH UT-100
HD-41183	HEAT SHIELD ATTACHMENT

General

Splice connectors and several OE ring terminal connectors use heat shrink covering to seal the connection.

Preparing Wire Leads

NOTE

If adjacent wires are to be spliced, stagger the splices so that the sealed splice connectors will not touch each other but are located at different positions along the length of the wires.

1. Using a shop gauge, identify the gauge of the wire.
2. Match the wire gauge to a sealed splice connector by color and part number. Refer to Table A-5.
3. Using a wire stripper, cut and strip a length of insulation off the wire ends. Refer to Table A-5 for the strip length.

Table A-5. Sealed Splice Connectors

WIRE GAUGE	COLOR	PART NO.	STRIP LENGTH
18-20 (0.5-0.8 mm)	Red	70585-93	3/8 in. (9.5 mm)
14-16 (1.0-2.0 mm)	Blue	70586-93	3/8 in. (9.5 mm)
10-12 (3.0-5.0 mm)	Yellow	70587-93	3/8 in. (9.5 mm)

NOTE

If any copper wire strands are cut off of the wire core, trim the end and strip the wire again in a larger gauge stripper.

Splicing Wire Leads

NOTE

See Figure A-53. The connector is crimped twice - one side and then the other.

1. See Figure A-52. Open the PACKARD CRIMPING TOOL (Part No. HD-38125-8) ratchet by squeezing the handles closed.
2. Match the connector color to the wire gauge crimp die in the jaws and insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure A-53. Feed the stripped end of a wire into the connector until the wire stops inside the metal insert (1).
5. Squeeze the handles tightly closed to crimp the lead in the insert (2). The tool automatically opens when the crimping is complete.
6. Slide the connector to the other half of the metal insert. Insert the stripped wire lead (1) until it stops, and crimp the lead in the insert (2).

WARNING

Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

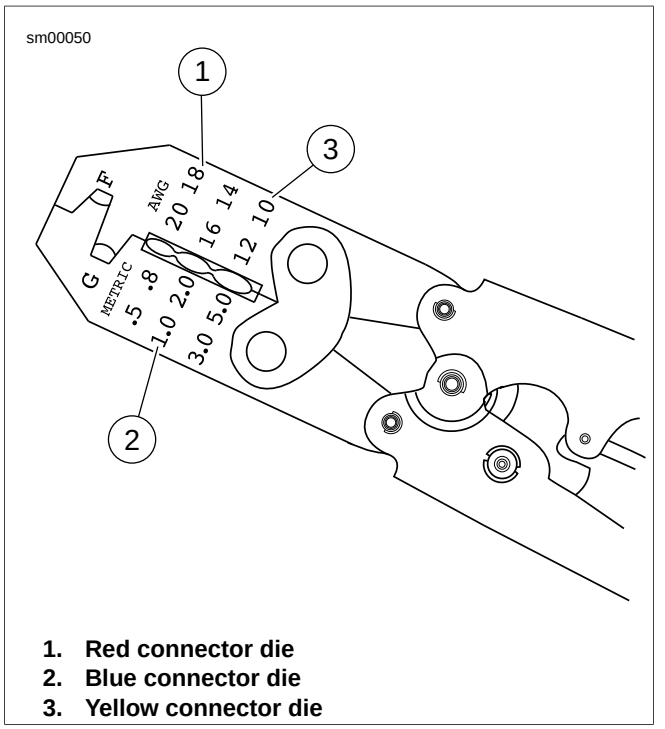
7. Use an ULTRA TORCH UT-100 (Part No. HD-39969), or a ROBINAIR HEAT GUN (Part No. HD-25070) with a HEAT SHIELD ATTACHMENT (Part No. HD-41183), to heat the connector from the center of the crimp (3) out to each end.

NOTE

It is acceptable for the splice to rest against the heat shrink tool attachment.

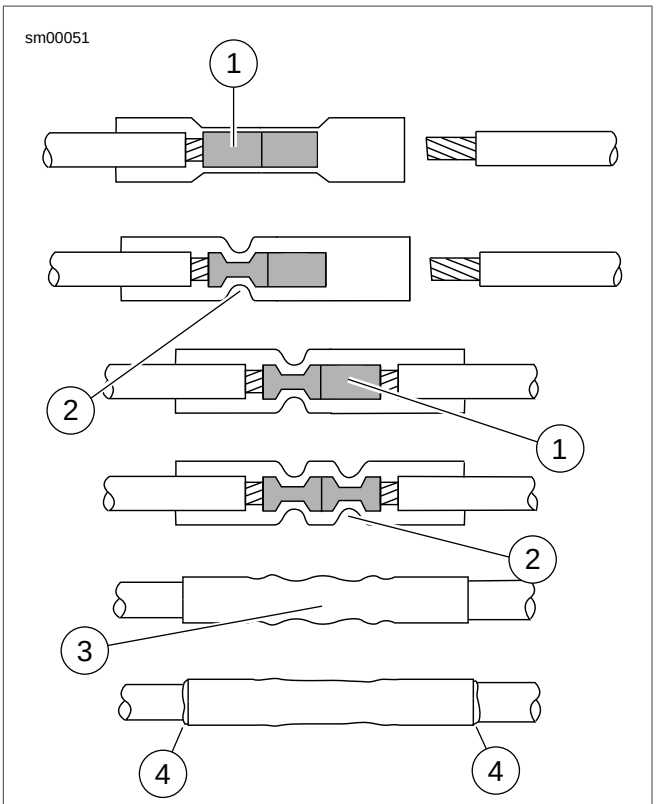
Inspecting Seals

See Figure A-53. Allow the splice to cool and inspect the seal. The insulation should appear smooth and cylindrical. Melted sealant will have extruded out the ends (4) of the insulation.



1. Red connector die
2. Blue connector die
3. Yellow connector die

Figure A-52. Packard Crimping Tool (HD-38125-8)



1. Wire lead in metal insert
2. Crimp metal insert
3. Center of crimp
4. Melted sealant

Figure A-53. Sealed Splice Connector

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

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B.2 WIRING DIAGRAMS.....B-19

DIGITAL TECHNICIAN® II
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NOTES

CONNECTORS B.1

CONNECTOR LOCATIONS

Function/Location

On the motorcycle, a connector can be identified by its function and location. Refer to Table B-1, Table B-2 or Table B-3.

Place and Color

The place (number of wire cavities of a connector housing) and color of the connector can also aid identification.

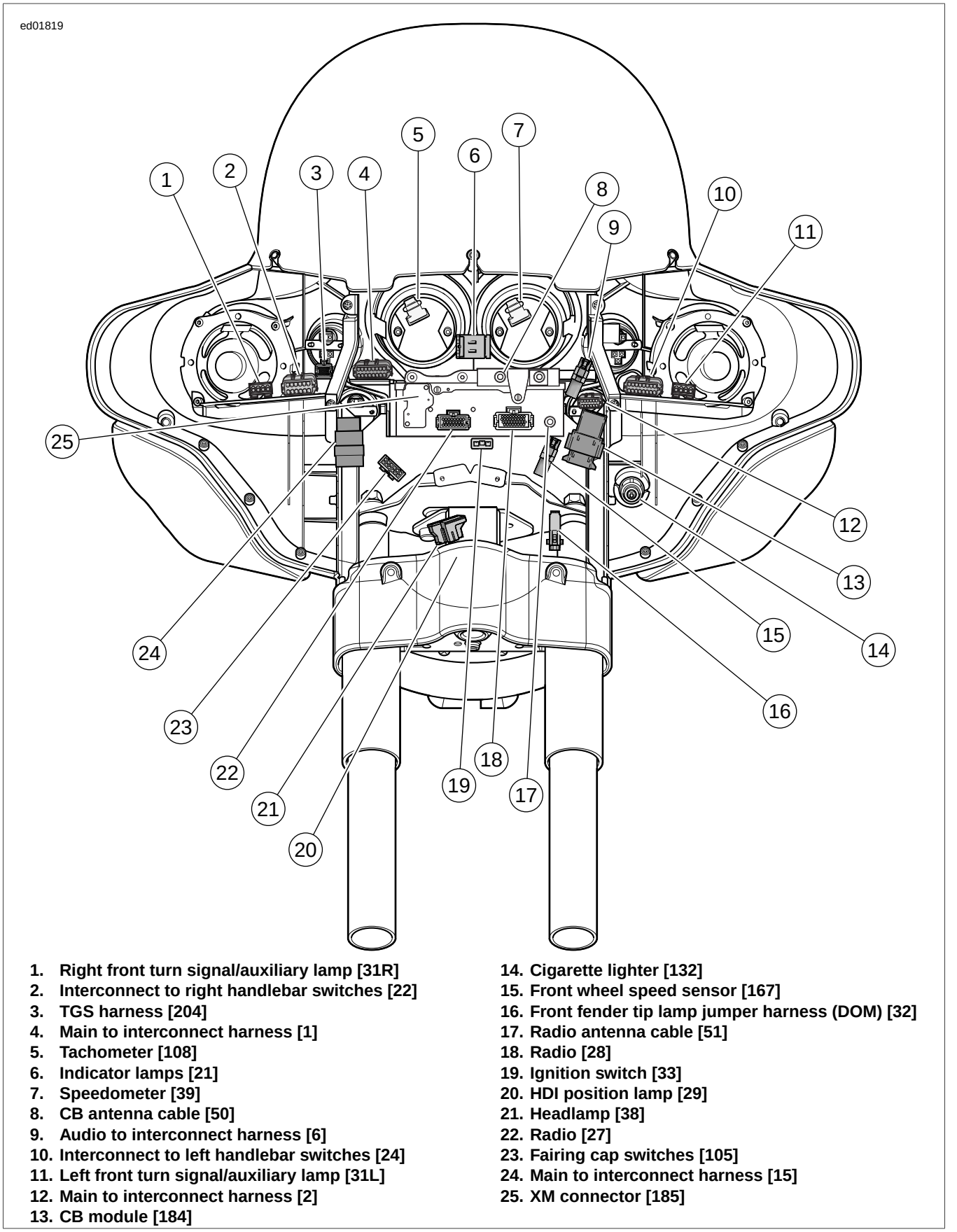
Connector Number

On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets.

Repair Instructions

The repair instructions in this Service Manual are by connector type. Refer to Table B-1, Table B-2 or Table B-3.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Right front turn signal/auxiliary lamp [31R]
2. Interconnect to right handlebar switches [22]
3. TGS harness [204]
4. Main to interconnect harness [1]
5. Tachometer [108]
6. Indicator lamps [21]
7. Speedometer [39]
8. CB antenna cable [50]
9. Audio to interconnect harness [6]
10. Interconnect to left handlebar switches [24]
11. Left front turn signal/auxiliary lamp [31L]
12. Main to interconnect harness [2]
13. CB module [184]
14. Cigarette lighter [132]
15. Front wheel speed sensor [167]
16. Front fender tip lamp jumper harness (DOM) [32]
17. Radio antenna cable [51]
18. Radio [28]
19. Ignition switch [33]
20. HDI position lamp [29]
21. Headlamp [38]
22. Radio [27]
23. Fairing cap switches [105]
24. Main to interconnect harness [15]
25. XM connector [185]

Figure B-1. Inner Fairing Connectors (FLHX, FLHT/C/U)

Table B-1. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	Inner fairing - right radio support bracket
[2]	Main to interconnect harness	12-place Molex (gray)	Inner fairing - left radio support bracket
[4]	Accessory	4-place Deutsch	Under seat
[5]	MAXIFUSE	2-place Packard	Under left side cover
[6]	Audio to interconnect harness	6-place Deutsch (black)	Inner fairing - left side of radio
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[12]	Tour-Pak lights (rear facia lamp on FLHX)	3-place Multilock	Inside Tour-Pak (inboard of upper frame tube on FLHX)
[13]	Fuel tank harness	4-place Multilock	Behind fuel tank (under seat)
[15]	Main to interconnect harness	4-place Delphi	Inner fairing - right fairing bracket
[18]	Left rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[19]	Right rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[21]	Indicator lamps	10-place Multilock	Inner fairing - above radio
[22]	Interconnect to right handlebar switches	12-place Molex (black)	Inner fairing - right fairing support bracket
[24]	Interconnect to left handlebar switches	16-place Molex (gray)	Inner fairing - left fairing support brace
[27]	Radio*	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[28]	Radio**	35-place Amp (Tyco)	Inner fairing - back of radio (left side)
[29]	HDI position lamp	Spade terminals	Back of headlamp
[30]	TSM/TSSM/HFSM	12-place Deutsch	Under right side cover
[31L]	Left front turn signal/auxiliary lamp	4-place Multilock	Inner fairing - left fairing support brace (outboard side)
[31R]	Right front turn signal/auxiliary lamp	4-place Multilock	Inner fairing - right fairing support brace (outboard side)
[32]	Front fender tip lamp jumper harness (DOM)	2-place Multilock (black)	Inner fairing - below upper for bracket (left side)
[33]	Ignition Switch	3-place Packard	Bottom of ignition switch
[34]	Right front speaker	Spade terminals	Inner fairing (back of speaker)
[35]	Left front speaker	Spade terminals	Inner fairing (back of speaker)
[38]	Headlamp	Headlamp connector	Inner fairing (back of headlamp)
[39]	Speedometer	12-place Packard	Inner fairing (back of speedometer)
[41]	Rear right speaker/passenger controls**	6-place Deutsch	Inside rear right speaker box
[42]	Rear left speaker/passenger controls**	6-place Deutsch	Inside rear left speaker box
[45]	Rear fender tip lamp (DOM)	3-place Multilock	Circuit board under tail lamp assembly
[47]	Stator	3-place Lyall	Bottom of voltage regulator (left side)
[50]	CB antenna cable**	-	Inner fairing - back of CB module
[51]	Radio antenna cable**	-	Inner fairing - back of radio (left side)
[53]	Console pod**	12-place Deutsch	Rear of battery box (under seat)
[64]	Fuse block/relays	Packard	Under left side cover
[65]	VSS	3-place Delphi	Top of transmission case (under starter)
[76]	Passenger headset	7-place DIN	Below rear left speaker box
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)
[78]	ECM	73-place Delphi	Under seat

Table B-1. FLHX, FLHT/C/U Connector Locations

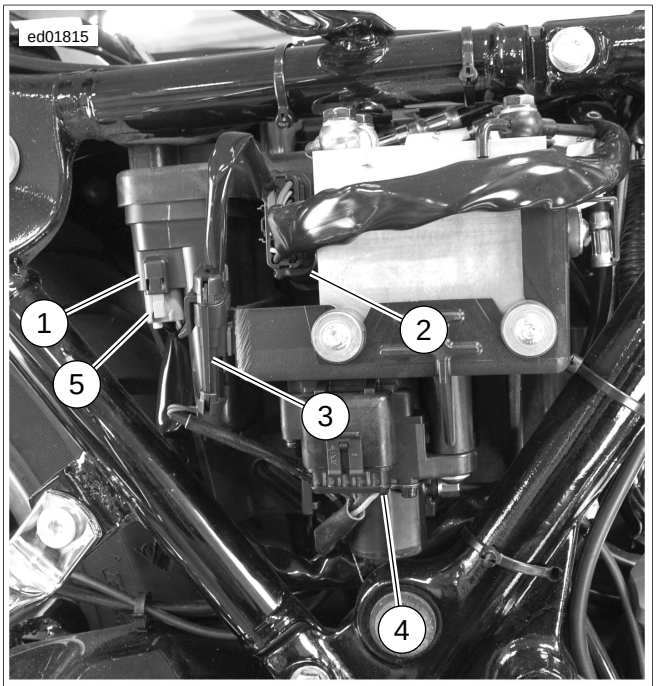
NO.	DESCRIPTION	TYPE	LOCATION
[79]	CKP sensor	2-place Deutsch	Rear of lower front frame crossmember
[80]	TMAP sensor	4-place Bosch	Top of induction module
[83]	Ignition coil	4-place Delphi	Bottom front of battery tray
[84]	Front injector	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	4-place Deutsch	Under left side cover
[93]	Tail lamp	4-place Multilock	Circuit board under tail lamp assembly
[94]	Rear fender lights harness in circuit board	6-place Multilock	Circuit board under tail lamp assembly
[95]	Purge solenoid	2-place Delphi	Under seat
[105]	Fairing cap switches	12-place Multilock	Inner fairing - above upper fork bracket (right side)
[107]	Ambient Air Temperature (AAT) sensor*	3-place Multilock	Steering head, left side
[108]	Tachometer	12-place Packard	Inner fairing (back of tachometer)
[111]	Voltmeter lamp	Spade terminals	Inner fairing (back of voltmeter)
[112]	Oil pressure gauge lamp	Spade terminals	Inner fairing (back of oil pressure gauge)
[113]	Oil pressure gauge	Spade terminals	Inner fairing (back of oil pressure gauge)
[114]	Air temperature gauge lamp	Spade terminals	Inner fairing (back of air temperature gauge)
[115]	Air temperature gauge	Spade terminals	Inner fairing (back of air temperature gauge)
[116]	Fuel gauge lamp	Spade terminals	Inner fairing (back of fuel gauge)
[117]	Fuel gauge	Spade terminals	Inner fairing (back of fuel gauge)
[120]	Oil pressure switch	2-place Delphi	Front right crankcase
[121]	Rear stop lamp switch	Spade terminals	Bottom of rear frame downtube (right side)
[122]	Horn	Spade terminals	Between cylinders (left side)
[128]	Starter solenoid	Spade terminals	Top of starter
[GND1] [GND1A] [GND2]	Harness grounds	Ring terminals	Under seat
[131]	Neutral switch	Post terminals	Top of transmission (right side)
[132]	Cigarette lighter*	Spade terminals	Inner fairing
[133]	Jiffy stand sensor	3-place Molex (black)	Domestic (not used): Rear of lower front frame crossmember.
			HDI: Rear of lower front frame cross-member.
[134]	BAS	3-place Packard	Under right side cover
[137]	O2 sensor rear exhaust header	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	2-place Amp (Tyco)	Back of cross brace between front frame downtubes
[141]	Fuel pump and fuel level sender	4-place Packard	Under console on top of fuel tank canopy

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Table B-1. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[142]	Security siren (optional)	3-place Delphi	Under left side cover
[143]	Front fender tip lamp (DOM)	2-place Multilock	Under front fender tip lamp bracket
[160]	B+	1-place Delphi	Under seat
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Packard	Inner fairing - below upper fork bracket (left side)
[168]	Rear wheel speed sensor	2-place Packard	Under right side cover
[179]	Active exhaust actuator	5-place Amp (Tyco)	Domestic (not used)
			HDI: Under right side cover
[184]	CB module	12-place Deutsch	Inner fairing - left side of radio
[185]	XM connector	1-place	Inner fairing - back of radio
[201]	ABS diode	4-place Deutsch	Under left side cover (below fuse box)
[204]	TGS harness	6-place Molex (black)	Inner fairing - right fairing support bracket
[208]	HFSM antenna jumper harness	4-place Deutsch	Under right side cover
[209]	HFSM antenna	2-place Molex	Under seat
[211]	TCA	6-place Molex	Right side of engine (induction module)
[224]	TGS	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)
*Classic and Ultra **Ultra Only			

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. TSM/TSSM/HFSM [30]
2. ABS Control Module [166]
3. Rear Wheel Speed Sensor [168]
4. Active exhaust actuator [179]
5. HFSM antenna jumper harness [208]

Figure B-2. ABS Connector

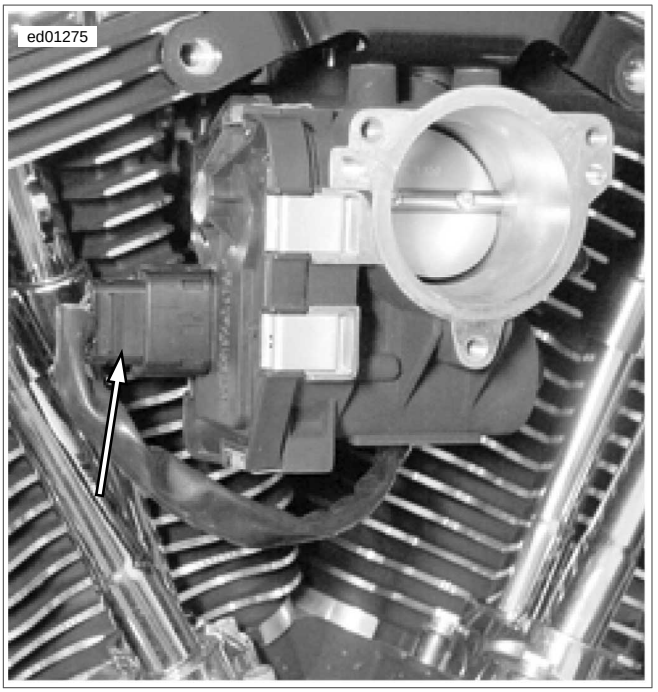


Figure B-3. Throttle Control Connector

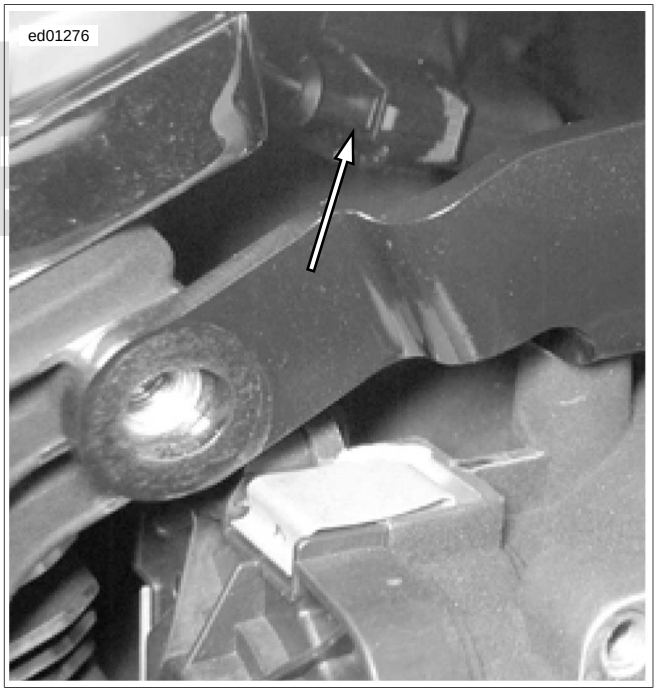
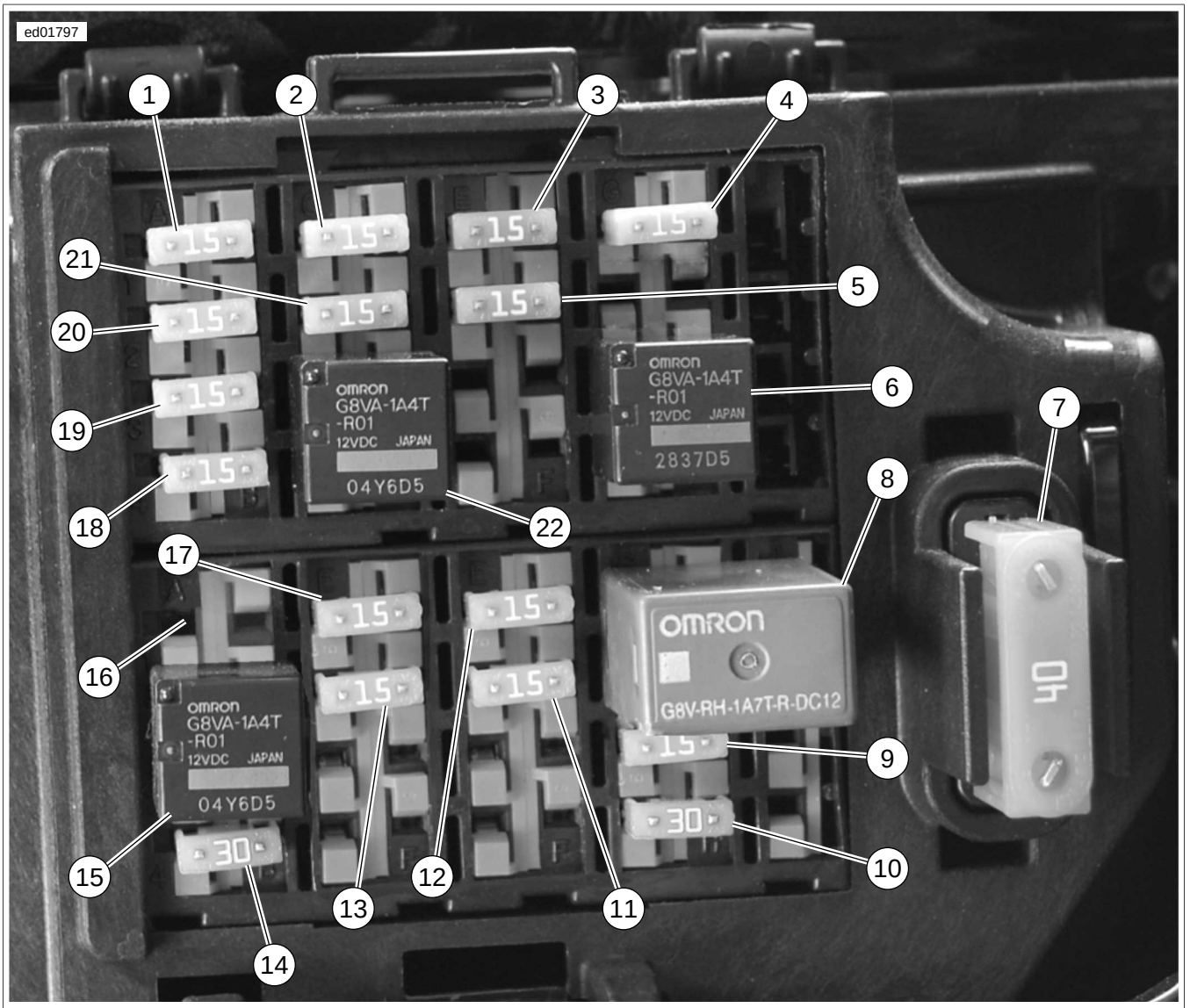
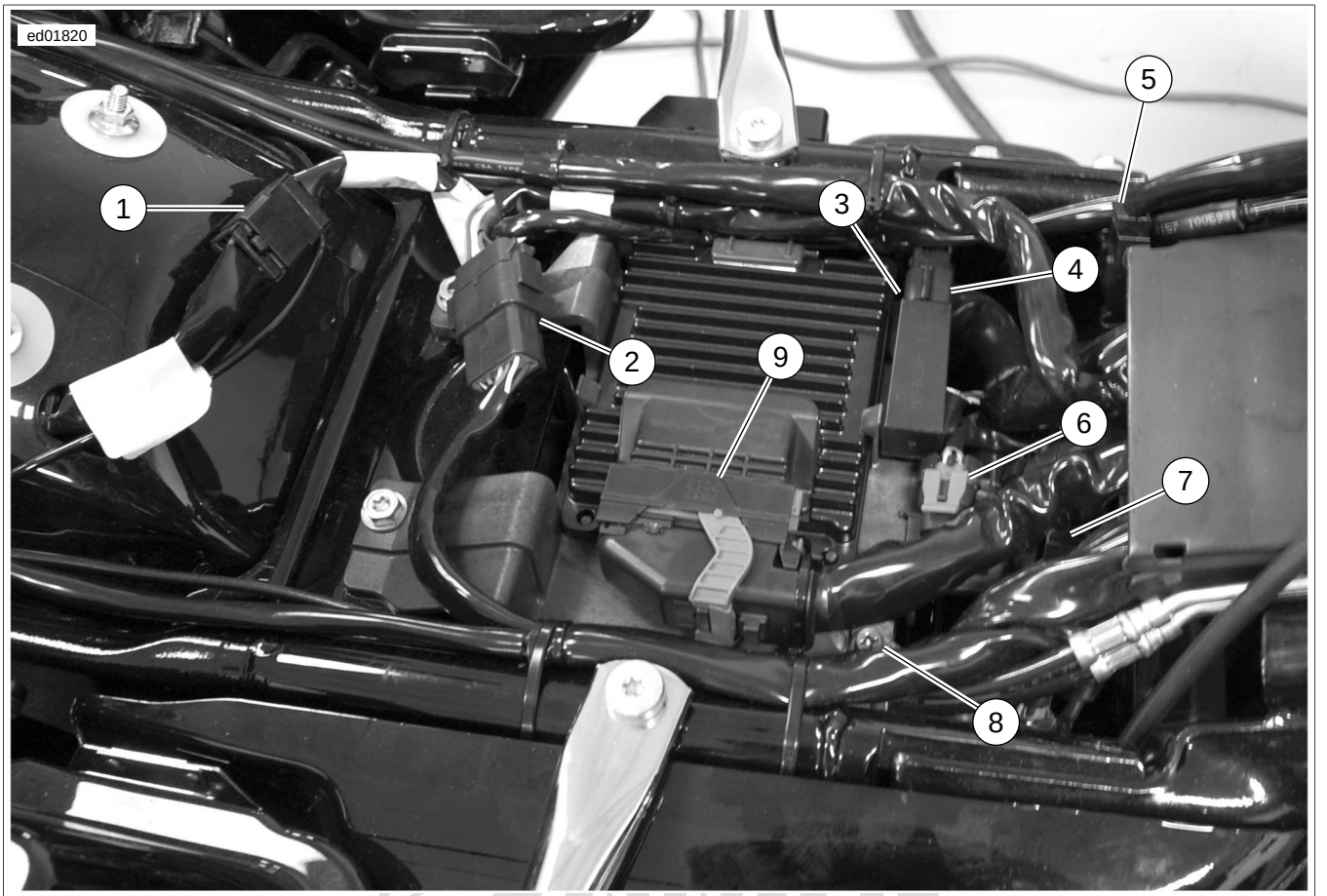


Figure B-4. TMAP Connector



1. Brake/cruise
2. Accessory
3. P&A
4. Radio power/Siren
5. ECM power
6. Start relay
7. MAXIFUSE
8. Lighting relay
9. Spare
10. Spare
11. Lights
12. Ignition
13. Headlamp
14. ABS
15. Brake relay
16. P&A IGN (2A Max)
17. Instruments
18. Fuel pump
19. Exhaust control
20. Radio memory
21. Battery
22. System relay

Figure B-5. Fuse and Relay Locations



1. Tail Light Connector [7]
2. Console pod [53]
3. Positive Battery Terminal
4. Hands-Free Antenna Connector [209]
5. Fuel Pump Subharness Connector [13]
6. Purge solenoid [95]
7. P&A Accessory Connector [4]
8. Negative Battery Terminal
9. ECM [78]

Figure B-6. Electrical Connectors - Under Seat

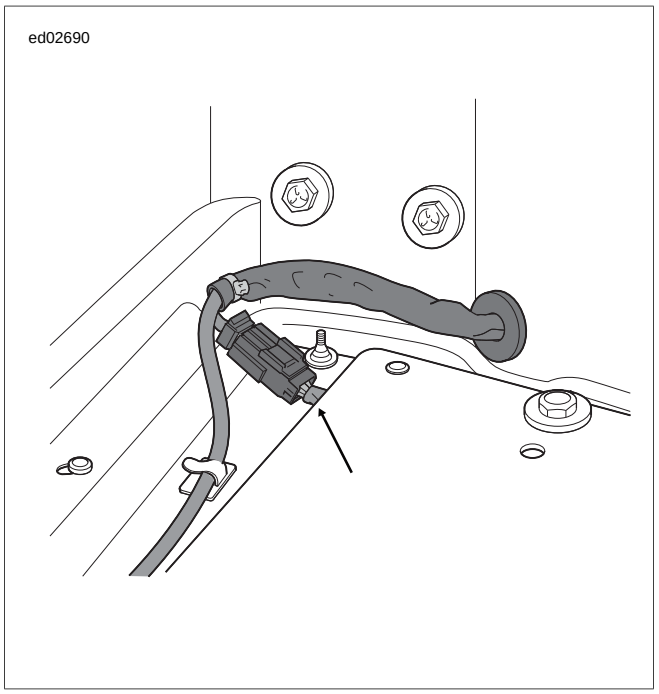
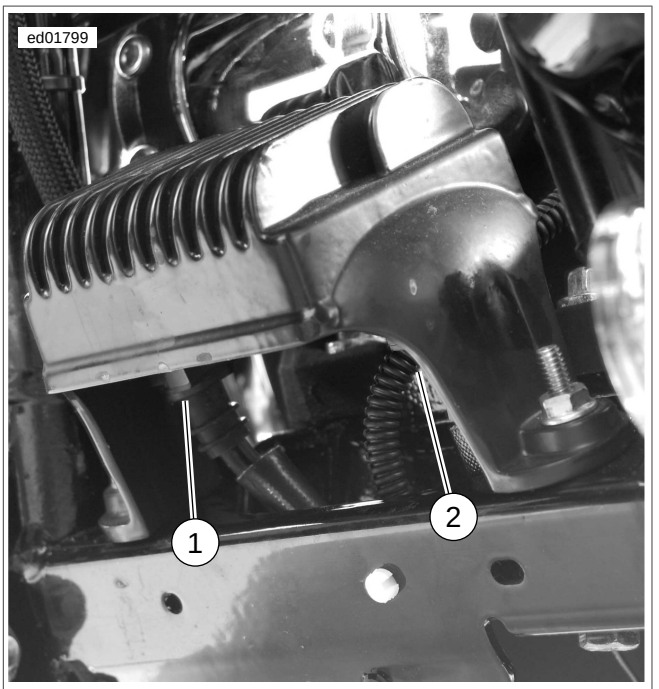


Figure B-7. Tour-Pak Connectors (Left Side)



1. **Voltage regulator [77]**
2. **Stator [47]**

Figure B-9. Voltage Regulator (Left Side View)

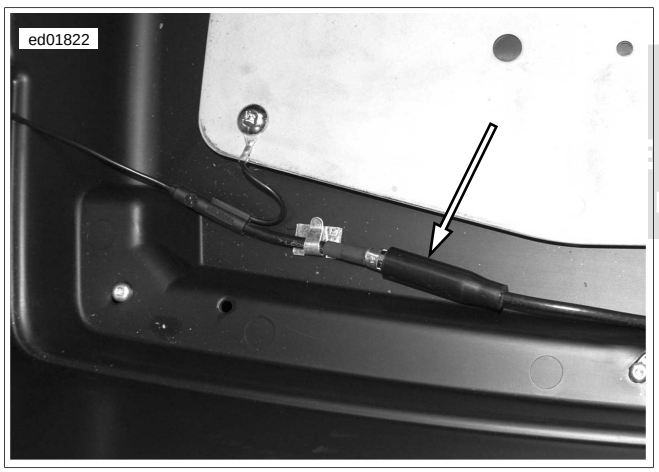


Figure B-8. Tour-Pak Connectors (Right Side)

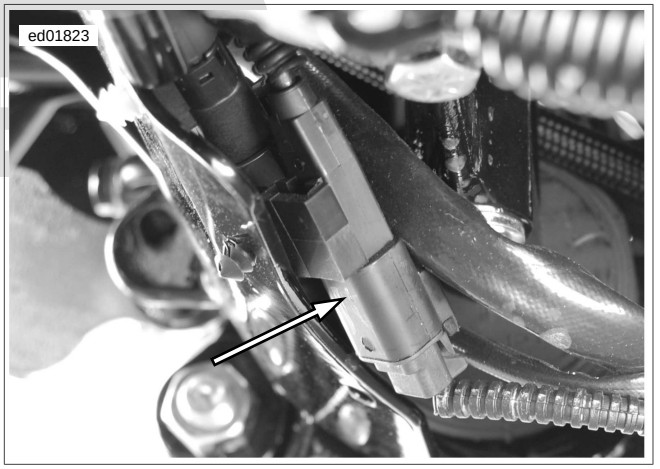
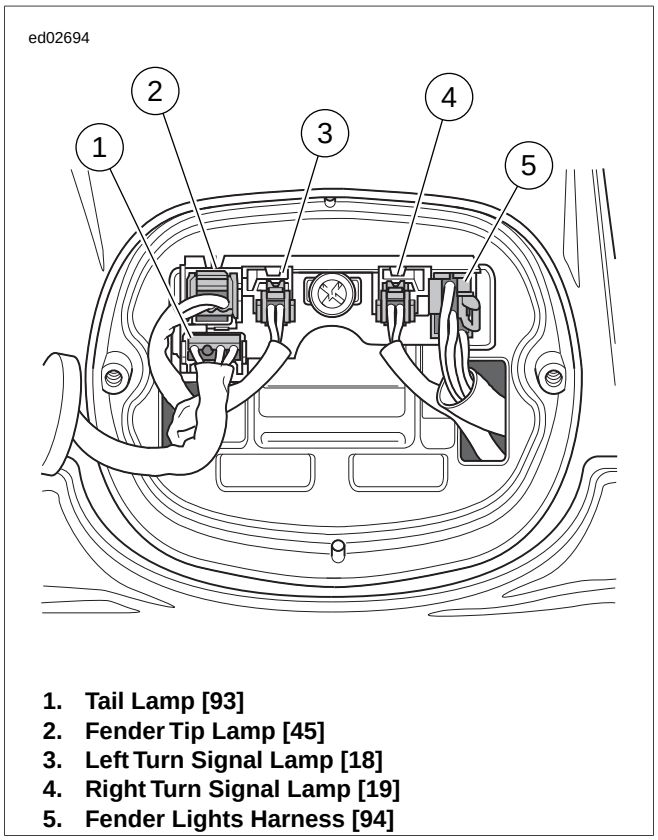


Figure B-10. CKP Sensor [79] (from underneath)

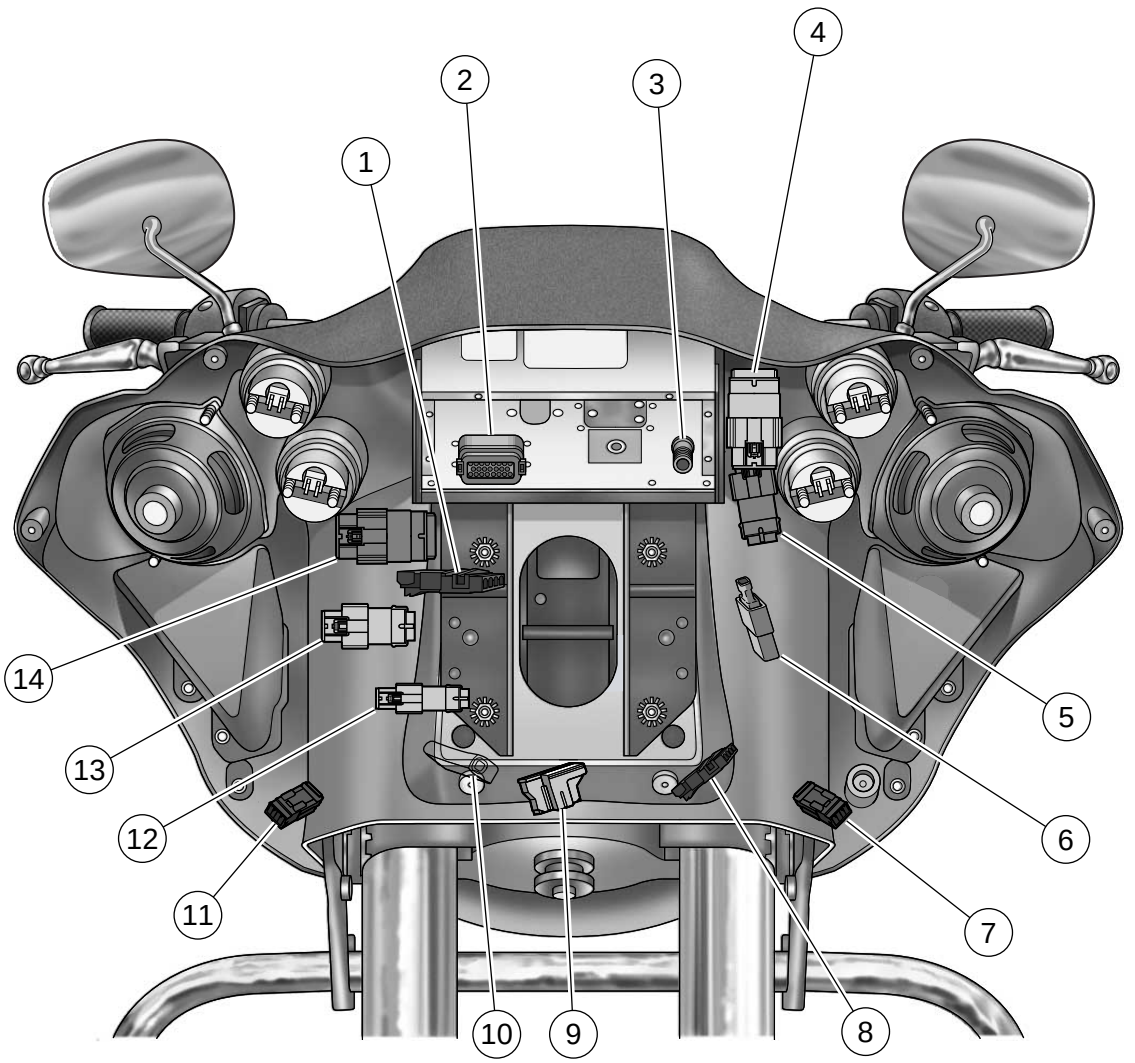


1. **Tail Lamp [93]**
2. **Fender Tip Lamp [45]**
3. **Left Turn Signal Lamp [18]**
4. **Right Turn Signal Lamp [19]**
5. **Fender Lights Harness [94]**

Figure B-11. Rear Fender Lights Assembly

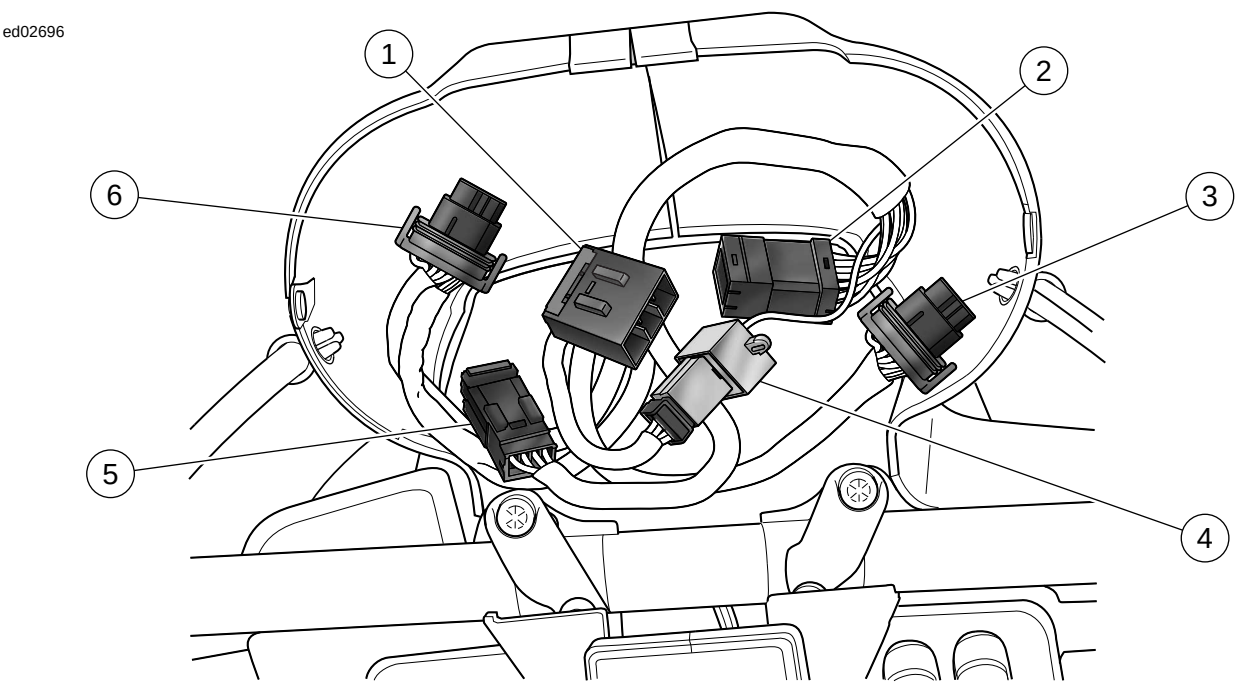
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1. Main to interconnect harness [15]
2. Radio [27]
3. Radio antenna cable [51]
4. Interconnect to left handlebar switches [24]
5. Interconnect to right handlebar switches [22]
6. Audio to interconnect harness [6]
7. Left front turn signal/auxiliary lamp [31L]
8. Front wheel speed sensor [167]
9. Headlamp [38]
10. HDI position lamp [29]
11. Right front turn signal/auxiliary lamp [31R]
12. TGS harness [204]
13. Main to interconnect harness [2]
14. Main to interconnect harness [1]

Figure B-12. Inner Fairing Connectors (FLTR)



1. **Indicator Lamps [21]**
2. **Instrument Nacelle Switches [105A/B]**
3. **Tachometer [108]**
4. **Ambient Temperature Sensor [107]**
5. **Speaker Switch [105C/D]**
6. **Speedometer [39]**

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Figure B-13. Instrument Nacelle Connectors (FLTR)

Table B-2. FLTR Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	Inner fairing - right side below radio
[2]	Main to interconnect harness	12-place Molex (gray)	Inner fairing - left radio support bracket
[4]	Accessory	4-place Deutsch	Upper frame crossmember (under seat)
[5]	MAXIFUSE	2-place Packard	Under left side cover
[6]	Audio connector	6-place Deutsch	Inner fairing - right fairing support brace
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[13]	Fuel tank harness	4-place Multilock	Behind fuel tank (under seat)
[15]	Main to interconnect harness	4-place Delphi	Inner fairing - below radio (right side)
[18]	Left rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[19]	Right rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[21]	Indicator lamps	10-place Multilock	Inner fairing - above radio
[22]	Interconnect to right handlebar switches	12-place Molex (black)	Inner fairing - right fairing support bracket
[24]	Interconnect to left handlebar switches	16-place Molex (gray)	Inner fairing - left fairing support brace
[27]	Radio	23-place Amp (Tyco)	Inner fairing - back of radio (right side)

Table B-2. FLTR Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[29]	HDI position lamp	Spade terminals	Back of headlamp
[30]	TSM/HFSM	12-place Deutsch	Under right side cover
[31L]	Left front turn signal	4-place Multilock	Inner fairing - left (outboard side)
[31R]	Right front turn signal	4-place Multilock	Inner fairing - right (outboard side)
[33]	Ignition switch	3-place Packard	Bottom of ignition switch
[34]	Right front speaker	Spade terminals	Inner fairing (back of speaker)
[35]	Left front speaker	Spade terminals	Inner fairing (back of speaker)
[38]	Headlamp	Headlamp connector	Inner fairing (back of headlamp)
[39]	Speedometer	12-place Packard	Instrument nacelle (back of speedo-meter)
[45]	Rear fender tip lamp (DOM)	3-place Multilock	Circuit board under tail lamp assembly
[47]	Stator	3-place Lyall	Bottom of voltage regulator (left side)
[51]	Radio antenna cable	-	Inner fairing - back of radio (left side)
[64]	Fuse block/relays	Packard	Under left side cover
[65]	VSS	3-place Delphi	Top of transmission case (under starter)
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)
[78]	ECM	73-place Delphi	Under seat
[79]	CKP sensor	2-place Deutsch	Rear of lower front frame crossmember
[80]	TMAP sensor	4-place Bosch	Top of induction module
[83]	Ignition coil	4-place Delphi	Lower front of battery tray
[84]	Front injector	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	4-place Deutsch	Under left side cover
[93]	Tail lamp	4-place Multilock	Circuit board under tail lamp assembly
[94]	Rear fender lights harness in circuit board	6-place Multilock	Circuit board under tail lamp assembly
[95]	Purge solenoid	2-place Delphi	Under seat
[105]	Instrument nacelle switches		
	Interconnect to nacelle switch harness (105A, 105B)	12-place Multilock	Inside instrument nacelle (under bezel)
	Nacelle switch harness to speaker switch (105C, 105D)	4-place Multilock	Inside instrument nacelle (under bezel)
[107]	Ambient Air Temperature (AAT) sensor	3-place Multilock	Inside instrument nacelle (under bezel)
[108]	Tachometer	12-place Packard (gray)	Instrument nacelle (back of tacho-meter)
[111]	Voltmeter lamp	Spade terminals	Inner fairing (back of voltmeter)
[112]	Oil pressure gauge lamp	Spade terminals	Inner fairing (back of oil pressure gauge)
[113]	Oil pressure gauge	Spade terminals	Inner fairing (back of oil pressure gauge)
[114]	Air temperature gauge lamp	Spade terminals	Inner fairing (back of air temperature gauge)
[115]	Air temperature gauge	Spade terminals	Inner fairing (back of air temperature gauge)

Table B-2. FLTR Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[116]	Fuel gauge lamp	Spade terminals	Inner fairing (back of fuel gauge)
[117]	Fuel gauge	Spade terminals	Inner fairing (back of fuel gauge)
[121]	Rear brake light switch	Spade terminals	Mid-chassis, lower right side (between frame and exhaust pipe)
[122]	Horn	Spade terminals	Between cylinders (right side)
[128]	Starter solenoid	Spade terminals	Top of starter
[129]	Harness grounds	Ring terminals	Upper frame crossmember (under seat)
[131]	Neutral switch	Post terminals	Top of transmission (right side)
[132]	Cigarette lighter	Spade terminals	Inner fairing
[133]	Jiffy stand sensor	3-place Molex (black)	Domestic (not used): Rear of lower front frame crossmember.
			HDI: Rear of lower front frame cross-member.
[134]	Sidecar Bank Angle Sensor (BAS)	3-place Packard	Under seat
[135]	EFI system relay	Relay	Fuse block (under right side cover)
[137]	O2 sensor rear exhaust header	2-place Amp (Tyco)	Under chrome starter cover
[138]	O2 sensor front exhaust header	2-place Amp (Tyco)	Back of cross brace between front frame downtubes (left side)
[139]	Oil pressure switch	2-place Delphi	Front right crankcase
[141]	Fuel pump and fuel level sender	4-place Packard	Top of canopy (under console)
[142]	Security siren (optional)	3-place Delphi	Under left side cover
[160]	B+	1-place Delphi	Under seat
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Delphi (black)	Inner fairing - below upper fork bracket (left side)
[168]	Rear wheel speed sensor	2-place Delphi (black)	Under right side cover
[179]	Active exhaust actuator	5-place Amp (Tyco)	Domestic (not used)
			HDI: Under right side cover
[201]	ABS diode	4-place Deutsch	Under left side cover (below fuse box)
[204]	TGS harness	6-place Molex (black)	Inner fairing - right side below radio
[208]	HFSM antenna jumper harness	4-place Deutsch	Right side cover
[209]	HFSM antenna	2-place Molex	Under seat
[211]	TCA	6-place Molex	Right side of engine (induction module)
[224]	TGS	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)

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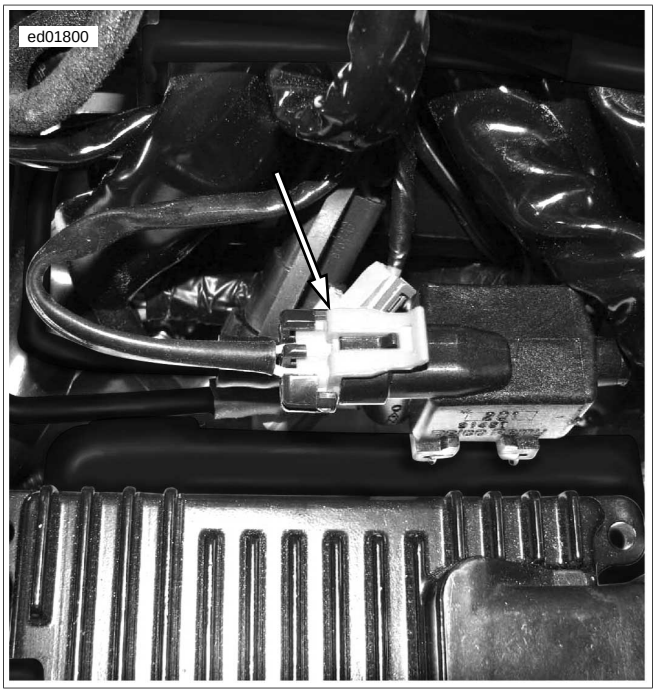


Figure B-14. [95] Purge Solenoid (Under seat)

Table B-3. FLHR/C/S Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[4]	Accessory	4-place Deutsch	Upper frame crossmember (under seat)
[5]	MAXIFUSE	2-place Packard	Under left side cover
[7]	Rear fender lights harness	6-place Multilock	Top of rear fender (under seat)
[18]	Left rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[19]	Right rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[20]	Console harness	16-place Molex	Under seat
[21]	Indicator lamps	8-place Deutsch	Under console
[22]	Right handlebar switches	6-place Molex (black)	Inside headlamp nacelle - fork stem nut lock plate (right side)
[24]	Left handlebar switches	8-place Molex (gray)	Inside headlamp nacelle - fork stem nut lock plate (left side)
[30]	TSM//HFSM	12-place Deutsch	Under right side cover
[31]	Front turn signals	6-place Multilock	Inside headlamp nacelle - fork stem nut lock plate (left side)
[32]	Front fender tip lamp jumper harness (DOM)	2-place Multilock	Inside headlamp nacelle
[33]	Ignition switch	3-place Packard	Under console
[38]	Headlamp	Headlamp connector	Inside headlamp nacelle
[39]	Speedometer	12-place Packard	Back of speedometer (back of console)
[45]	Rear fender tip lamp (DOM)	3-place Multilock	Circuit board under tail lamp assembly
[47]	Stator	3-place Lyall	Bottom of voltage regulator (left side)
[64]	Fuse block/relays	Packard	Under left side cover
[65]	VSS	3-place Delphi	Top of transmission case (under starter)
[67]	Accessory switch	4-place Amp (Tyco)	Inside headlamp nacelle
[73]	Auxiliary lamps	2-place Multilock (white)	Inside headlamp nacelle
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)

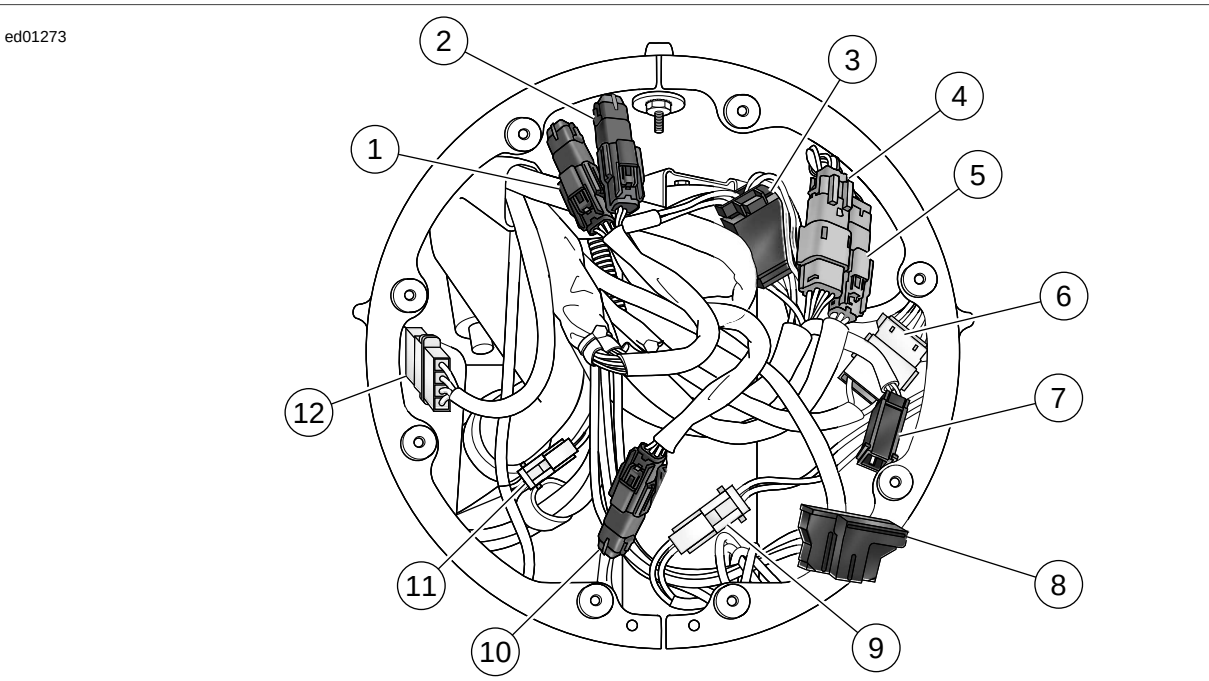
Table B-3. FLHR/C/S Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	73-place Delphi	Under seat
[79]	CKP sensor	2-place Deutsch	Rear of lower front frame crossmember
[80]	TMAP sensor	4-place Bosch	Top of induction module
[83]	Ignition coil	4-place Delphi	Lower front of battery tray
[84]	Front injector	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	4-place Deutsch	Under left side cover
[93]	Tail lamp	4-place Multilock	Circuit board under tail lamp assembly
[94]	Rear fender lights harness in circuit board	6-place Multilock	Circuit board under tail lamp assembly
[95]	Purge solenoid	2-place Delphi	Under seat
[108]	Optional tachometer	1-place Amp (Tyco)	Inside headlamp nacelle
[109]	Auxiliary lamps switch	4-place Amp (Tyco)	Inside headlamp nacelle
[117]	Fuel gauge	Spade terminals	Below fuel tank on left side
[121]	Rear brake light switch	Spade terminals	Mid-chassis, lower right side (between frame and exhaust pipe)
[122]	Horn	Spade terminals	Between cylinders (left side)
[128]	Starter solenoid	Spade terminals	Top of starter
[129]	Harness grounds	Ring terminals	Upper frame crossmember (under seat)
[131]	Neutral switch	Post terminals	Top of transmission (right side)
[133]	Jiffy stand sensor	3-place Molex (black)	Domestic: Rear of lower front frame crossmember.
			HDI: Rear of lower front frame cross-member.
[134]	Sidecar Bank Angle Sensor (BAS)	3-place Packard	Under seat
[137]	O2 sensor rear exhaust header	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	2-place Amp (Tyco)	Back of cross brace between front frame downtubes (left side)
[139]	Oil pressure switch	2-place Delphi	Front right crankcase
[141]	Fuel pump and fuel level sender	4-place Packard	Top of canopy (under console)
[142]	Security siren (optional)	3-place Delphi	Under left side cover
[143]	Front fender tip lamp (DOM)	2-place Multilock (black)	Under front fender tip lamp bracket
[158]	Left handlebar switches (cruise control)**	3-place Molex (black)	Inside headlamp nacelle
[159]	Right handlebar switches (cruise control)**	3-place Molex (gray)	Inside headlamp nacelle
[160]	B+	1-place Packard	Under seat
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Delphi (black)	Inner fairing - below upper fork bracket (left side)
[168]	Rear wheel speed sensor	2-place Delphi (black)	Under right side cover
[179]	Active exhaust actuator	5-place Amp (Tyco)	Domestic (not used)
			HDI: Under right side cover
[201]	ABS diode	4-place Deutsch	Under left side cover (below fuse box)

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Table B-3. FLHR/C/S Connector Locations

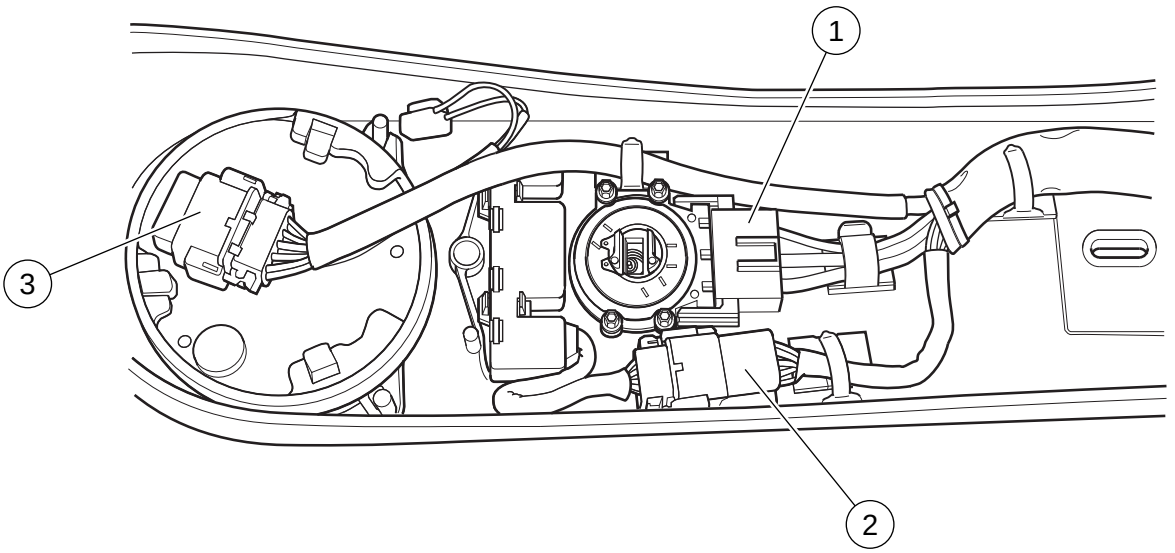
NO.	DESCRIPTION	TYPE	LOCATION
[204]	TGS harness	6-place Molex (black)	Inside headlamp nacelle - fork stem nut lock plate
[208]	HFSM antenna jumper harness	4-place Deutsch	Left side cover
[209]	HFSM antenna	2-place Molex	Under seat
[211]	TCA	6-place Molex	Throttle body
[222]	Console ignition switch interconnect	4-place Packard	Under seat
[224]	TGS	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)
** FLHRC Only			



1. **[22] Right Handlebar Switches**
2. **[24] Left Handlebar Switches**
3. **[31] Front Turn Signals**
4. **[32] Front Fender Tip Lamp (Used on FLHR Only)**
5. **[38] Headlamp**
6. **[67] Accessory Switch**
7. **[73] Auxiliary Lamps**
8. **[109] Auxiliary Lamps Switch**
9. **[158] Cruise On/Off Switch (Used on FLHR/C Only)**
10. **[159] Cruise Set/Resume Switch (Used on FLHR/C Only)**

Figure B-15. Headlamp Nacelle Connectors (FLHR/C)

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1. **Ignition/Light Key Switch [33]**
2. **Indicator Lights [21]**
3. **Speedometer [39]**

Figure B-16. Instrument Console Connectors (FLHR/C)

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WIRING DIAGRAMS B.2

WIRING DIAGRAM INFORMATION

Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table B-4.

For Solid Color Wires: See Figure B-17. The alpha code identifies wire color (3).

For Striped Wires: The code is written with a slash (/) between the solid color code and the stripe code (4). For example, a trace labeled GN / Y is a green wire with a yellow stripe.

Wiring Diagram Symbols

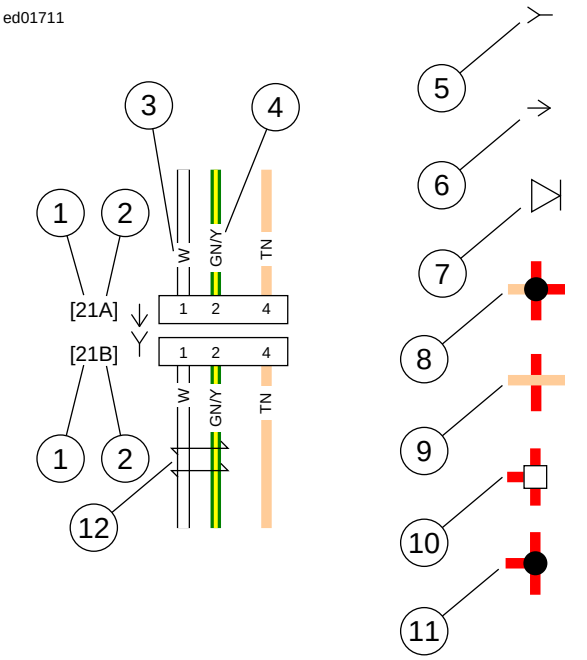
See Figure B-17. On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets (1). The letter (2) inside the brackets identifies whether the housing is a socket or pin housing.

A=Pin: The letter A after a connector number and the pin symbol (6) identifies a pin housing.

B=Socket: The letter B after a connector number and the socket symbol (5) identifies a socket housing.

Other symbols found on the wiring diagrams include the symbol for a diode (7), a symbol for a wire-to-wire connection (8), a symbol verifying that no connection (9) between two wire traces exists, symbols for actual (10) and virtual (11) splices, and a symbol identifying two wires that are twisted together (12).

Actual splices (10) are splices where two wires are connected together at a specific location along a wire. Virtual splices (11) are splices shown connected anywhere along a wire, usually used in a wiring or schematic diagram for clarity.



1. **Connector number**
2. **Terminal code (A=pin, B=socket)**
3. **Solid wire color**
4. **Striped wire color**
5. **Socket symbol**
6. **Pin symbol**
7. **Diode**
8. **Connection**
9. **No connection**
10. **Physical splice**
11. **Virtual splice**
12. **Twisted pair**

Figure B-17. Connector/Wiring Diagram Symbols (typical)

Table B-4. Wire Color Codes

ALPHA CODE	WIRE COLOR
BE	Blue
BK	Black
BN	Brown
GN	Green
GY	Grey
LGN	Light Green
O	Orange
PK	Pink
R	Red
TN	Tan
V	Violet
W	White
Y	Yellow

2009 TOURING WIRING DIAGRAMS

Wiring Diagram List

DIAGRAM	LOCATION
MAIN HARNESS (1 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-18
MAIN HARNESS (2 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-19
MAIN HARNESS (3 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-20
MAIN HARNESS (4 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-21
MAIN HARNESS (5 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-22
INTERCONNECT HARNESS: 2009 FLHT. FLHTX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-23
HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM ANTENNA: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC INTERNATIONAL MODELS	Figure B-24
STARTING AND CHARGING: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-25
STARTING AND CHARGING: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS	Figure B-26
TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, & TOUR-PAK LAMPS: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-27
HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMPS, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS, AND AUX LAMP/ACCESSORY SWITCHES: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS	Figure B-28
CONSOLE TO MAIN HARNESS INTERCONNECT, IGNITION SWITCH INTERCONNECT AND ALL DOMESTIC & INTERNATIONAL MODELS ABS HARNESS: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS	Figure B-29
2009 Composite Ultra Audio Circuit	Figure B-30
2009 Ultra Audio Interconnect Harness	Figure B-31
2009 Basic Radio Interconnect Circuit	Figure B-32
2009 Ultra Radio RF Interconnect Circuit	Figure B-33

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TSM/TSSM/HFSM
Battery 1 BN/GY
Ignition 2 GY
Serial Data 3 LGN/V
Neutral Switch 4 TN
Left Turn Feed 5 V
Right Turn Feed 6 BN
Right Turn SW Input 7 W/BN
Left Turn SW Input 8 W/V
Start Relay Control 9 TN/GN
Clutch Lockout Switch 10 BK/R
Alarm Signal 11 LGN/BN
Ground 12 BK/GN
[30A] [30B]
(GY)
To Main Harness (5 of 5)
R/BE
GN/O
BK/GN
BE/BK
W/BE
R/GN
LGN/V
GY
Y/GN
BE/GY
W/BK
BK
LGN/R
To Interconnect Harness [1A] (BK)
16 BE/BK
15 R/GN
14 W/BE
13 LGN/V
11 W/V
10 W/BN
9 O/BE
8 BN
7 V
6 W/BK
5 O/W
4 O/R
3 GY
2 O/V
1 O
[1B]
To Interconnect Harness [2A] (GY)
12 BK/GN
11 BK/R
10 TN
9 GN/Y
8 BN/GN
7 O
6 Y/BK
5 Y/W
4 BN/GY
3 BE
2 BK/R
1 R/BE
[2B]
To Interconnect Harness [15A]
D BK
C BK/GN
B BE
A R/O
[15B]
Oil Pressure Sender [139A]
B BN/GN
A GN/Y
[139B]
Fuel Pump
Fuel Pump Assembly Intank
A B C D [141A]
A B C D [141B]
Y/W O/GY BK/GN BK
70369-06 Fuel Tank Harness
O/GY Y/W BK/GN BK
1 2 3 4 [13B]
1 2 3 4 [13A]
Optional Security Siren
Power Signal Ground
1 2 3 [142A]
1 2 3 [142B]
BN/GY LGN/BN BK/GN
Red Band
BK
Battery
Start Solenoid [128B]
GN
Main Power At Starter
[BATT]
40 Amp MAXIFUSE
A B [5B]
Voltage Regulator
1 2 [77B]
B+ Connector [160B]
Ignition Switch [33A]
1 2 3 [33B]
R/GY R R/BK
64-1B
Brake 15A
Accessory 15A
P & A 15A
Radio Power/ Siren 15A
O/V 1B 1A
O/W 1D 1C R/GY
O/R 1F 1E R/GY
O/BE 1H 1G
GN 4G 5 87
R/GY 3H 3 30
TN/GN 3G 2 85
BK/R 4H 1 86
Start Relay
Radio Memory 15A
R/O 2B 2A R
Battery 15A
BN/GY 2D 2C R
ECM Power 15A
BE/GY 2F 2E R
Exhaust Control 15A
LGN/R 3B 3A R/BK
Fuel Pump 15A
O/GY 4B 4A
Y/GN 4C 5 87
BE/GY 3D 3 30
GN/O 3C 2 85
W/BK 4D 1 86
System Relay
P & A 2A IGN (MAX)
INSTRS 15A
Ignition 15A
O 1D 1C R/BK
GY 1F 1E R/BK
Lighting Relay
87 5 2G
30 3 1J R
85 2 2J
86 1 1G BK
Headlamp 15A
BE 2D 2C
Lights 15A
BE 2F 2E
Spare 15A
3H 3G
O/V 3A 5 87
R/Y 2B 3 30
R/BE 2A 2 85
BK 3B 1 86
Brake Relay
64-2B
Left GND Stud (Dirty)
BK GND1A
BK GND1
Right GND Stud (Clean)
GND2
BK/GN
BK/GN
Horn
Y/BK BK
[122A] [122B]
TN BK
Neutral Switch [131]
R/BE O/W
Rear Stop Light Switch [121]
[4A] 1 2 3 4
O/R R/Y O BK
Accessory Connector
[12B] (BK)
3 2 1
BK R/Y BE
Tour-Pak [12A]
1 2 3 5 6 7
BN O/W V BK R/Y BE
To Rear Lighting
[7A]

Figure B-18. MAIN HARNESS (1 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-18.
MAIN HARNESS (1 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

Figure B-18.
MAIN HARNESS (1 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

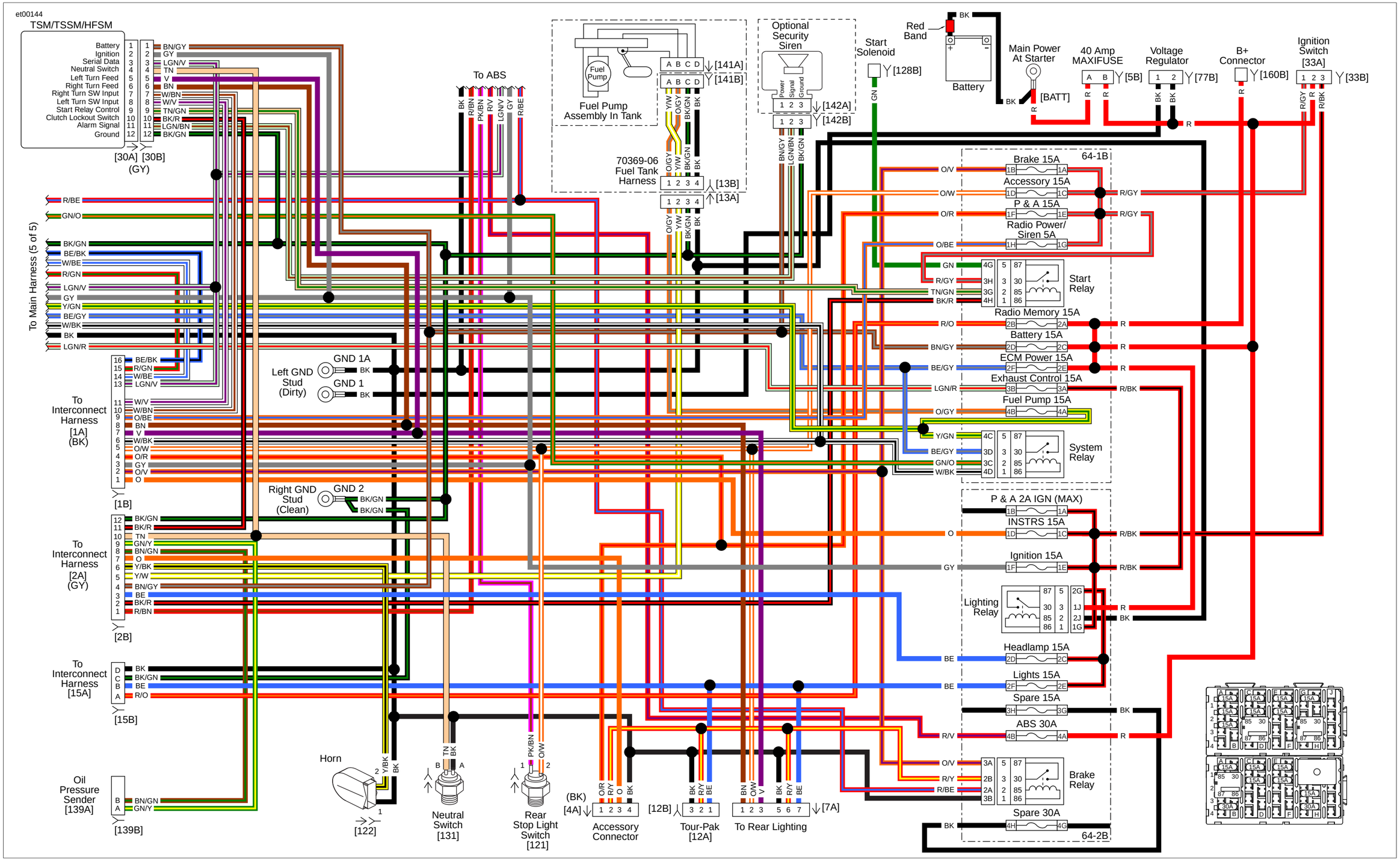


Figure B-19. MAIN HARNESS (2 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-19.
MAIN HARNESS (2 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

Figure B-19.
MAIN HARNESS (2 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

et00145

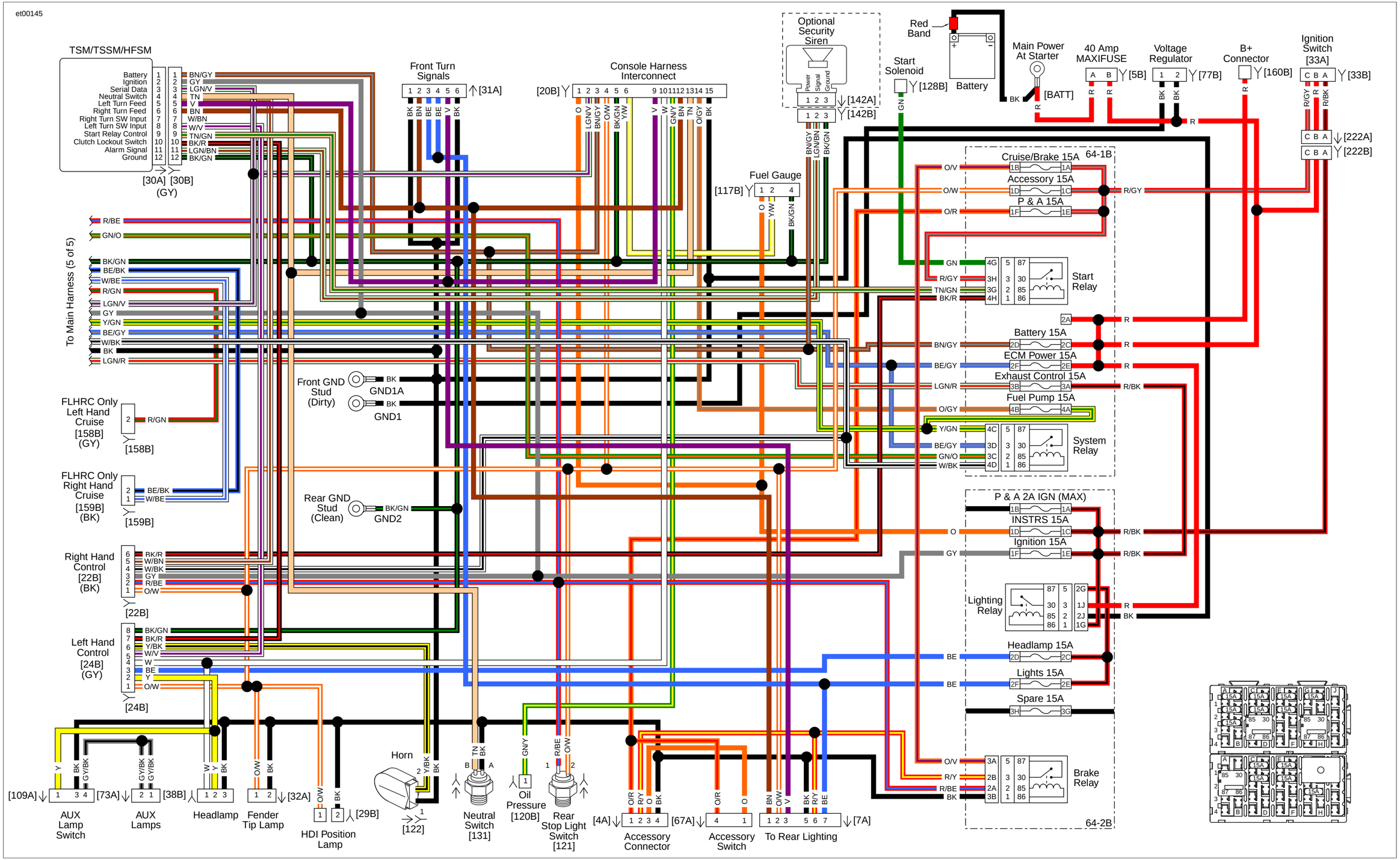


Figure B-20. MAIN HARNESS (3 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-20.
MAIN HARNESS (3 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

Figure B-20.
MAIN HARNESS (3 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

et00146

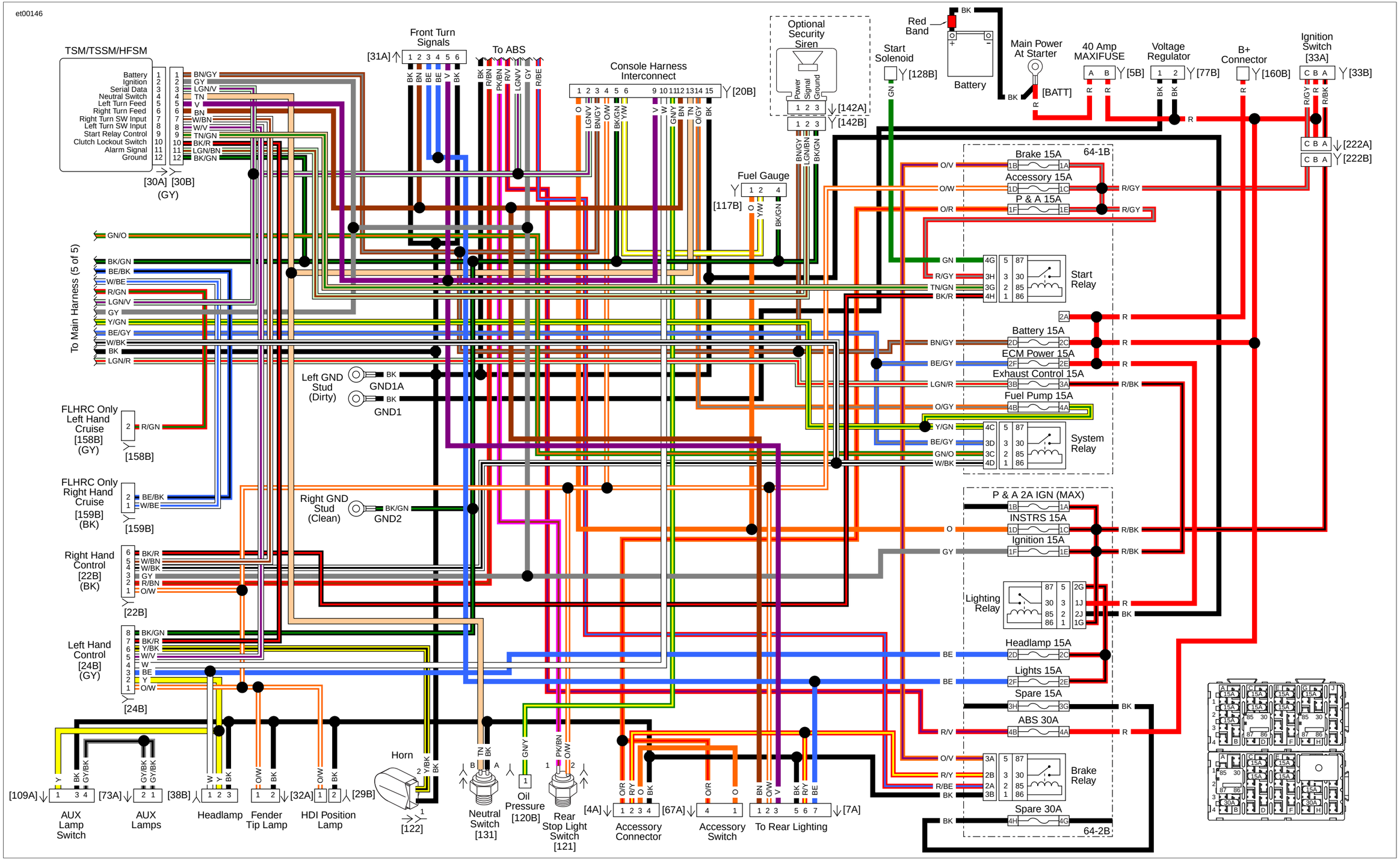


Figure B-21. MAIN HARNESS (4 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-21.
MAIN HARNESS (4 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

Figure B-21.
MAIN HARNESS (4 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

et00147

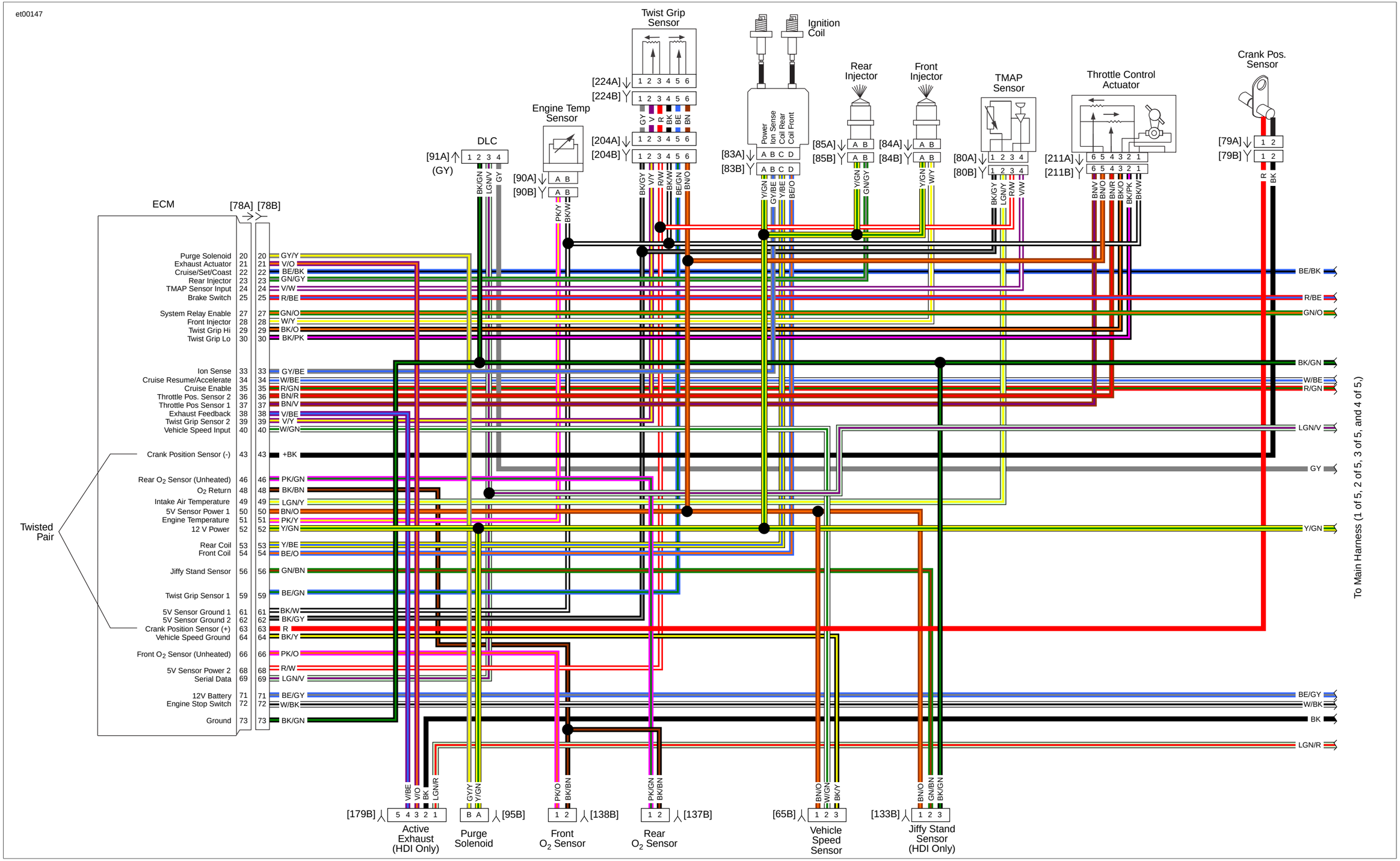


Figure B-22. MAIN HARNESS (5 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-22.
MAIN HARNESS (5 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

Figure B-22.
MAIN HARNESS (5 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

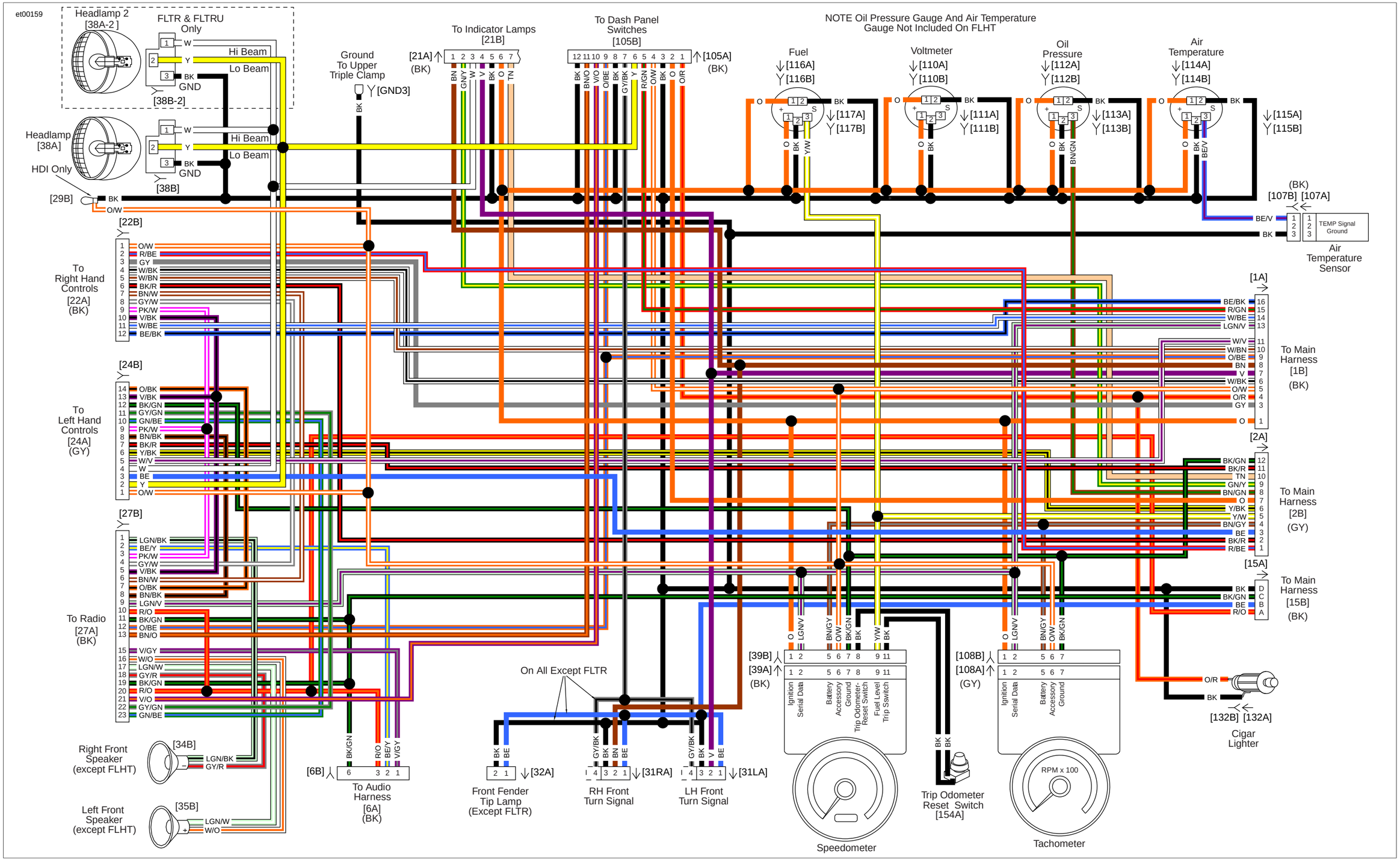


Figure B-23. INTERCONNECT HARNESS: 2009 FLHT. FLHTX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-23.
INTERCONNECT HARNESS: 2009 FLHT. FLHTX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-23.
INTERCONNECT HARNESS: 2009 FLHT. FLHTX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

et00150

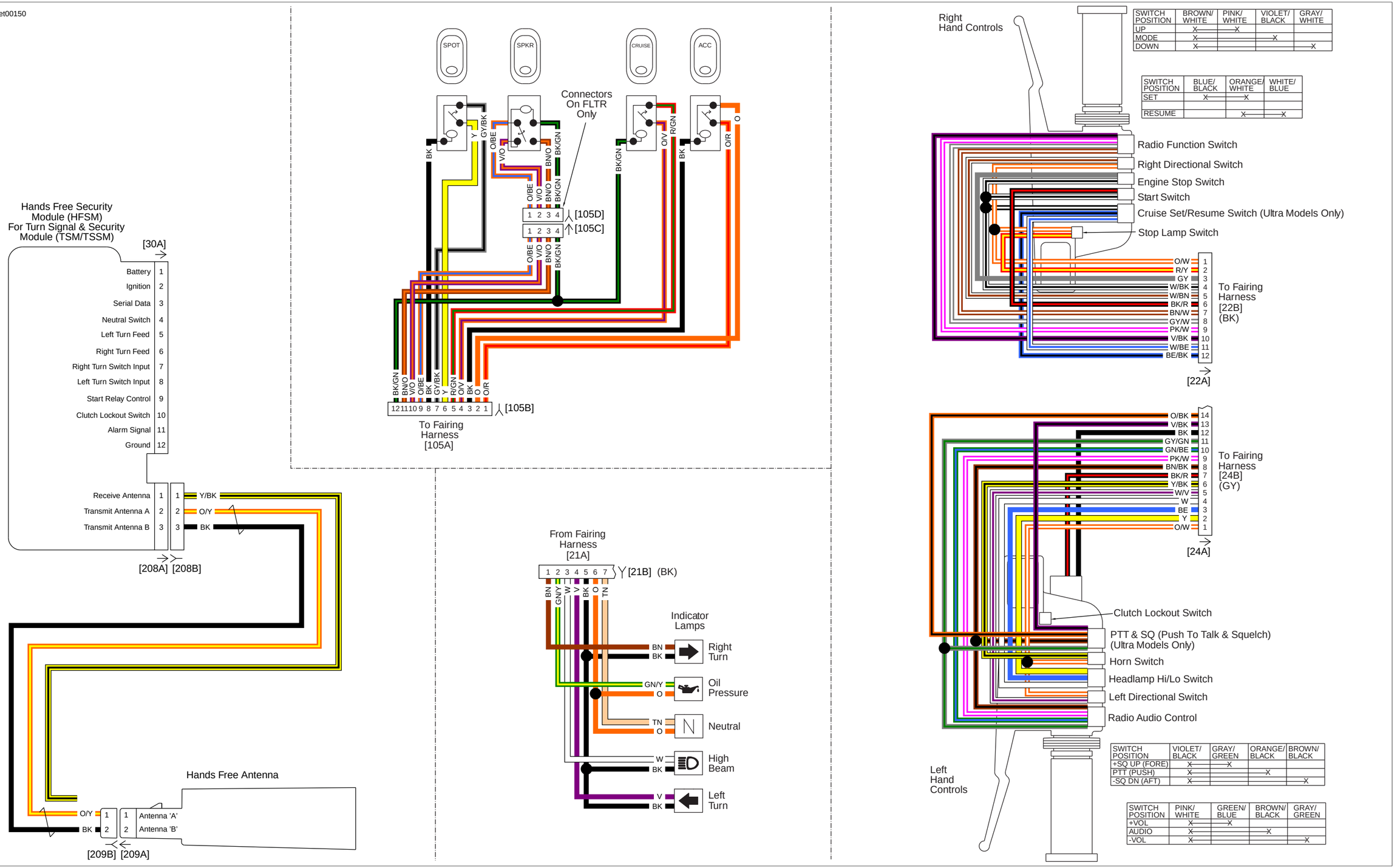
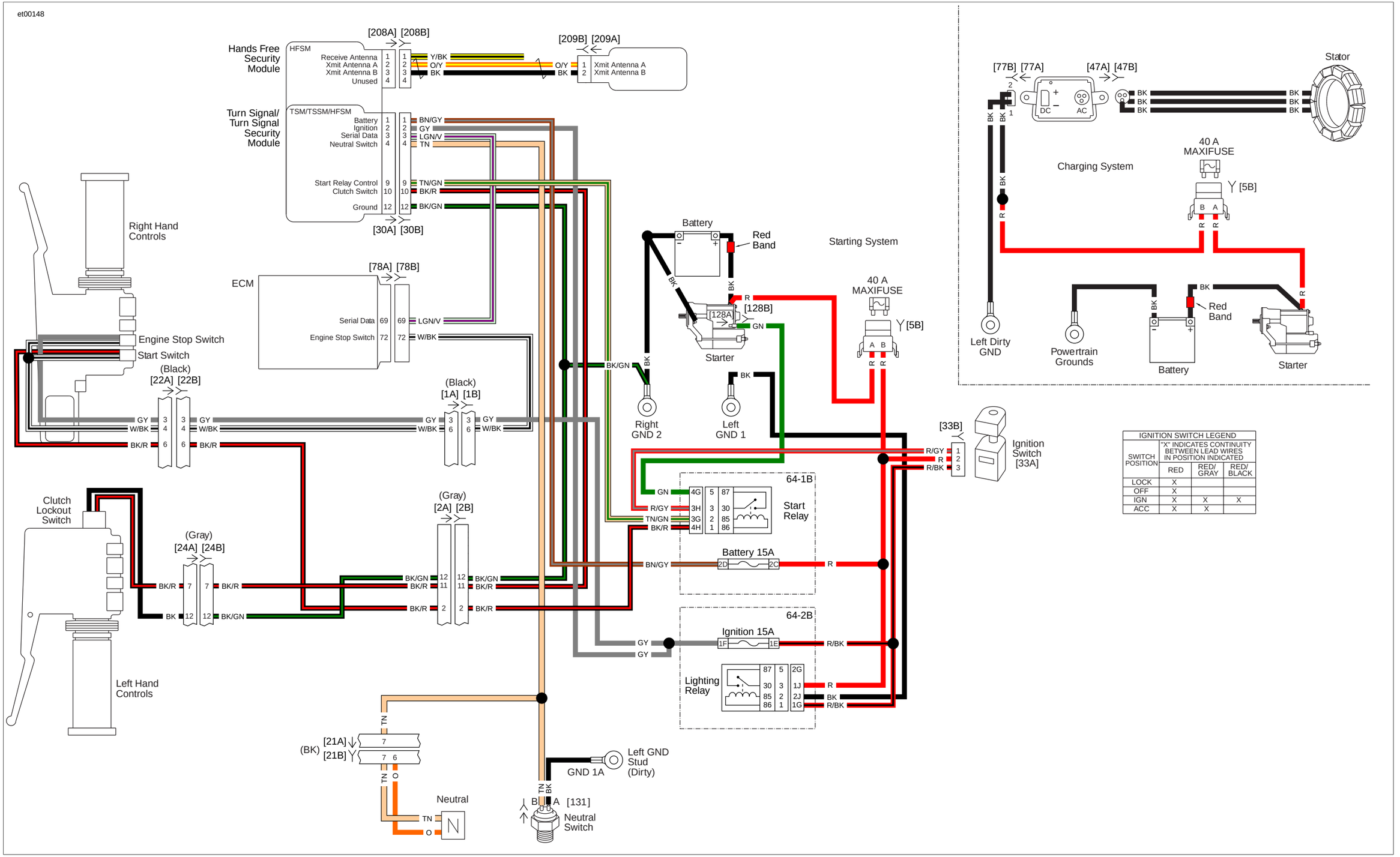


Figure B-24. HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM ANTENNA: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC INTERNATIONAL MODELS

Figure B-24.
HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM ANTENNA: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC INTERNATIONAL MODELS

Figure B-24.
HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM ANTENNA: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC INTERNATIONAL MODELS

et00148

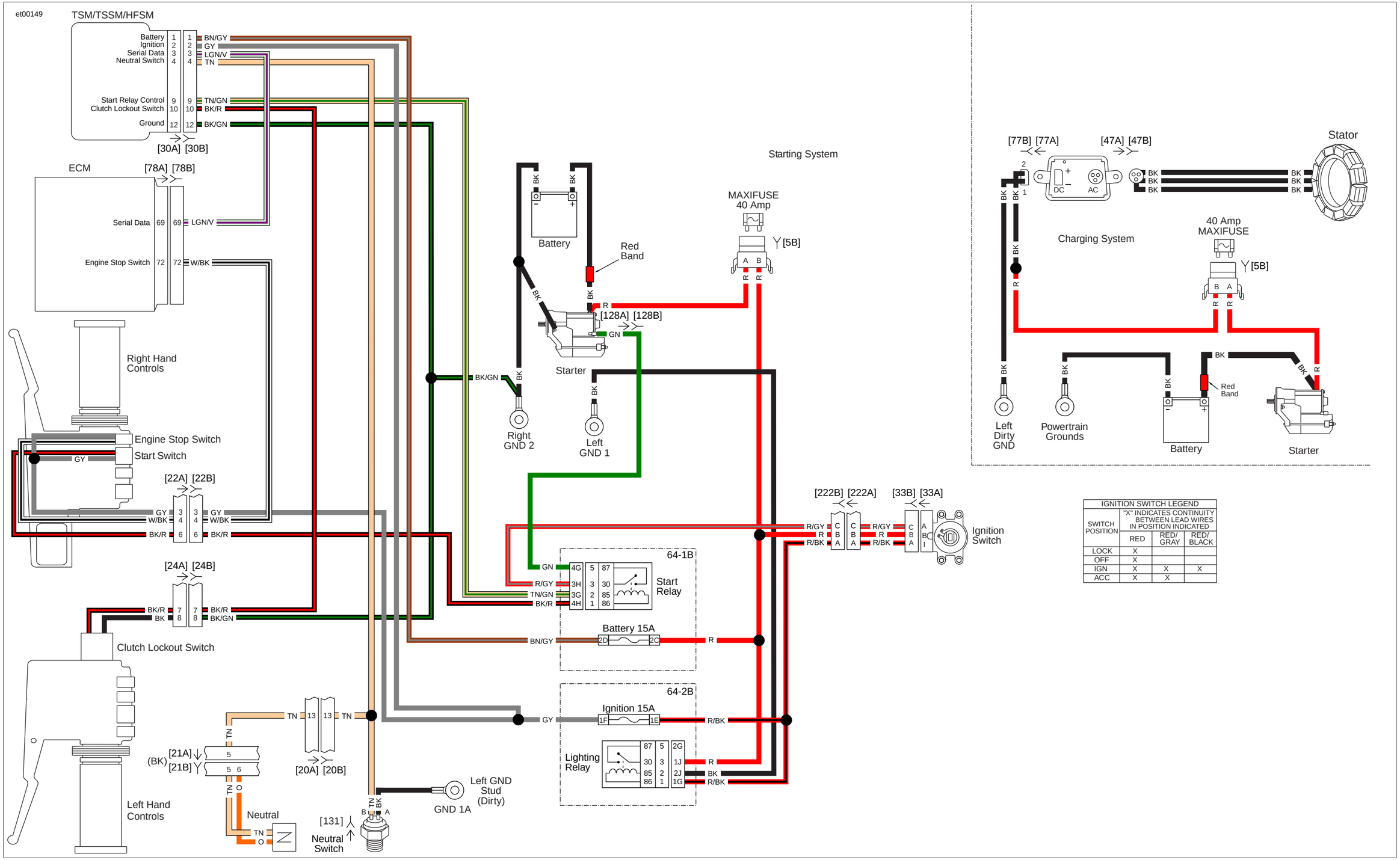


IGNITION SWITCH LEGEND			
SWITCH POSITION	"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED		
	RED	RED/ GRAY	RED/ BLACK
LOCK	X		
OFF	X		
IGN	X	X	X
ACC	X	X	

Figure B-25. STARTING AND CHARGING: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-25.
STARTING AND CHARGING: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-25.
STARTING AND CHARGING: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS



IGNITION SWITCH LEGEND

SWITCH POSITION	"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED		
	RED	RED/ GRAY	RED/ BLACK
LOCK	X		
OFF	X		
IGN	X	X	X
ACC	X	X	

Figure B-26. STARTING AND CHARGING: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-26.
STARTING AND CHARGING: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-26.
STARTING AND CHARGING: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

et00151

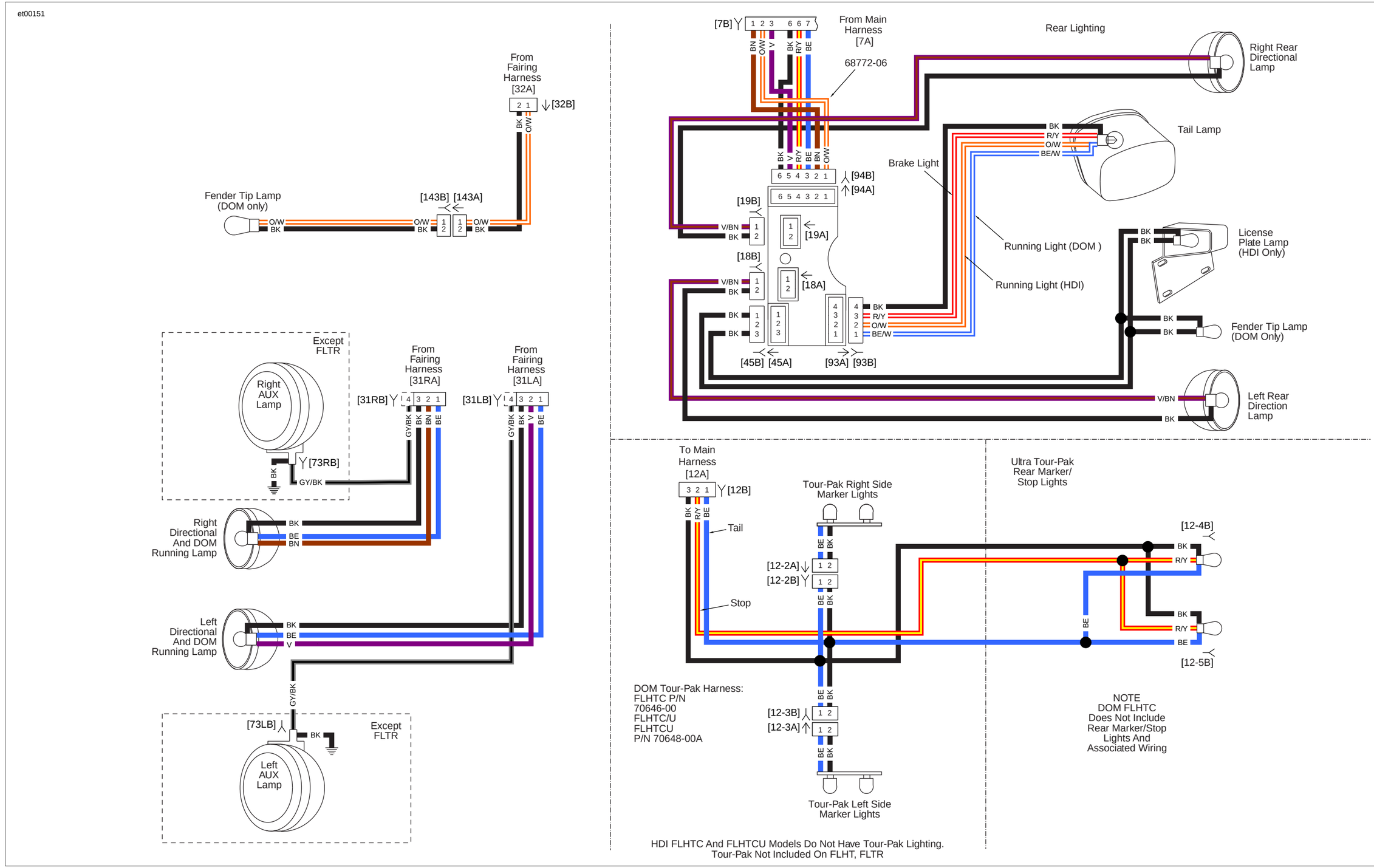


Figure B-27. TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, & TOUR-PAK LAMPS: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-27.
TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, & TOUR-PAK LAMPS: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-27.
TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, & TOUR-PAK LAMPS: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

et00152

Hands Free Security Module (HFSM)

For Turn Signal & Security Module (TSM/TSSM)

[30A]

Battery	1
Ignition	2
Serial Data	3
Neutral Switch	4
Left Turn Feed	5
Right Turn Feed	6
Right Turn Switch Input	7
Left Turn Switch Input	8
Start Relay Control	9
Clutch Lockout Switch	10
Alarm Signal	11
Ground	12

Receive Antenna 1 — Y/BK
XMIT Antenna A 2 — O/Y
XMIT Antenna B 3 — BK

[208A] [208B]

O/Y 1 — Antenna 'A'
BK 2 — Antenna 'B'

[209B] [209A]

From Main Harness [31A]

From Main Harness [73A]

[31B] 1 2 3 4 5 6 — BK BN BE BE V BK

[73B] (BK) 2 1 — GY/BK GY/BK

[32B] (BK) 2 1 — BK O/W

Right Auxiliary Lamp

[73RB] — GY/BK

Right Directional And DOM Running Lamp

GND — BK
Turn — BN
Running DOM Only — BE

Front Fender Tip Lamp (DOM only)

O/W
BK

Left Directional And DOM Running Lamp

GND — BK
Turn — V
Running DOM Only — BE

[73LB] — GY/BK

Left Auxiliary Lamp

Chassis Grounds

Handlebar Ground — BK — Triple Clamp Grounds

Frame Ground — BK — P/N 70142-93, P/N 70101-94

Rear Lighting Harness From Main Harness [7A]

[7B] 7 6 5 3 2 1 — BE R/Y BK V O/W BN

[94B]

O/W	1
BN	2
BE	3
R/Y	4
V	5
BK	6

Fuel Gauge

BK/GN
G
F
I
E
O
Y/W
O

[117A] 1 2 4 — O Y/W BK/GN

To Main Harness

Speedometer

[39A] 1 2 3 4 5 6 7 8 9 11

1	Ignition
2	Serial Data
3	NC
4	NC
5	Battery
6	Accessory
7	Ground
8	Trip Odometer Reset Switch
9	Fuel Level
11	Trip Switch

From Main Harness [67A] And [109A]

[109B] and/or [67B] 1 2 3 4 — BK BK BK BK

Rear View Of Toggle Switch With Keyway Down

On
Off
Keyway Down
Normally Closed
Common
Normally Open
BK
BK

Accessory/Aux Lamp Switch

Right Hand Controls

Right DIR Switch
Engine Stop Switch
Start Switch Cruise
Set/Resume Switch

[22A]

Stoplight Switch

O/W	1	From Main Harness [22B] (BK)
R/Y	2	
GY	3	
W/BK	4	
W/BN	5	
BK/R	6	

FLHRC Only

[159A]

BE/BK	2	From Main Harness [159B] (BK)
W/BE	1	

[24A]

O/W	1	From Main Harness [24B] (GY)
Y	2	
BE	3	
W	4	
W/V	5	
Y/BK	6	
BK/R	7	
BK	8	

[158A]

R/GN	2	From Main Harness [158B] (GY)

FLHRC Only

Clutch Lockout Switch
Cruise On/Off Switch
Horn Switch
Lights Hi/Low Switch
Left DIR Switch

Left Hand Controls

Right Rear Directional Lamp

V/BN
BK

From Main Harness [94B]

[19B] 6 5 4 3 2 1 — [94A]

V/BN BK — 1 2 — [19A]

[18B] — V/BN BK — 1 2 — [18A]

BK BK — 1 2 3 — 1 2 3 — 4 3 2 1

[45B] [45A] [93A] [93B]

Brake Light

Tail HDI Only

Tail DOM Only

BK
R/Y
O/W
BE

Taillamp

Fendertip Lamp (DOM) License Plate Lamp (HDI)

BK
BK
V/BN
BK

Left Rear Directional Lamp

From Main Harness [21A]

[21B] (BK) 1 2 3 4 5 6 7 — V W GN/Y BN TN O BK

Indicator Lamps

BN BK	Right Turn	
GN/Y O	Oil Pressure	
TN O	Neutral	
W BK	High Beam	
V BK	Left Turn	

Figure B-28. HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMPS, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS, AND AUX LAMP/ACCESSORY SWITCHES: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-28.
HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMPS, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS, AND AUX LAMP/ACCESSORY SWITCHES: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-28.
HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMPS, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS, AND AUX LAMP/ACCESSORY SWITCHES: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

et00154

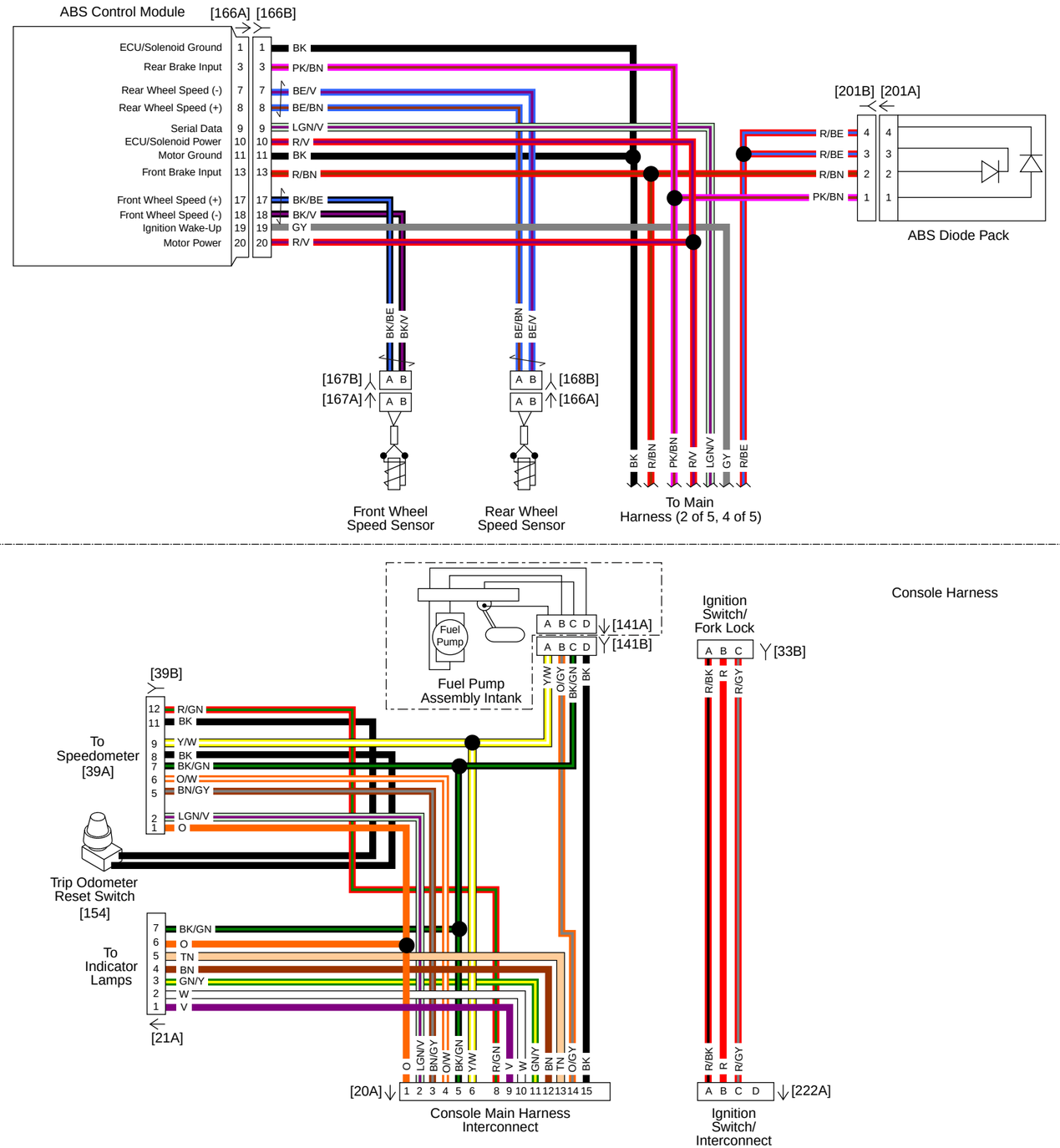


Figure B-29. CONSOLE TO MAIN HARNESS INTERCONNECT, IGNITION SWITCH INTERCONNECT AND ALL DOMESTIC & INTERNATIONAL MODELS ABS HARNESS: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-29.
CONSOLE TO MAIN HARNESS INTERCONNECT, IGNITION SWITCH INTERCONNECT AND ALL DOMESTIC & INTERNATIONAL MODELS ABS HARNESS: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-29.
CONSOLE TO MAIN HARNESS INTERCONNECT, IGNITION SWITCH INTERCONNECT AND ALL DOMESTIC & INTERNATIONAL MODELS ABS HARNESS: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

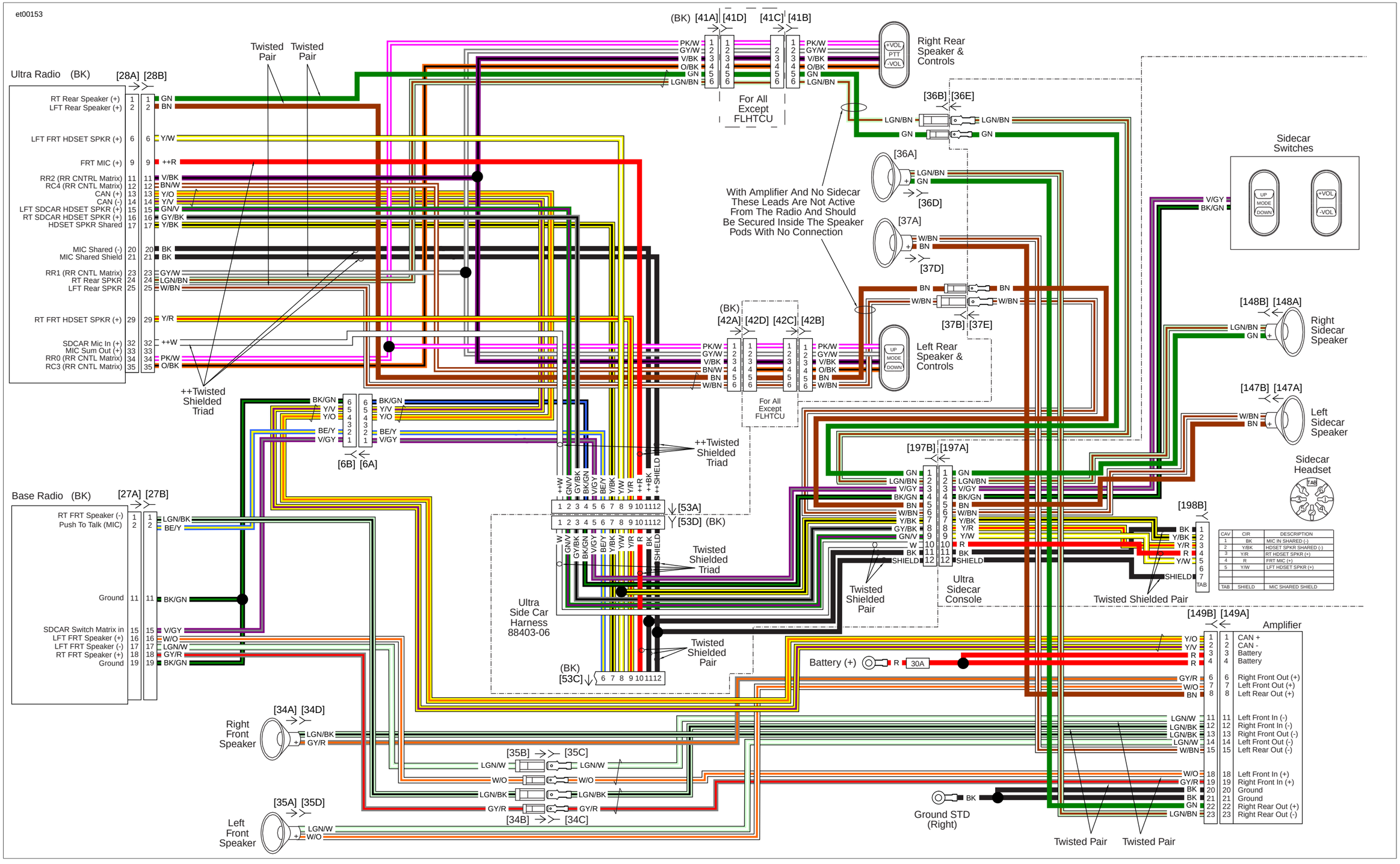
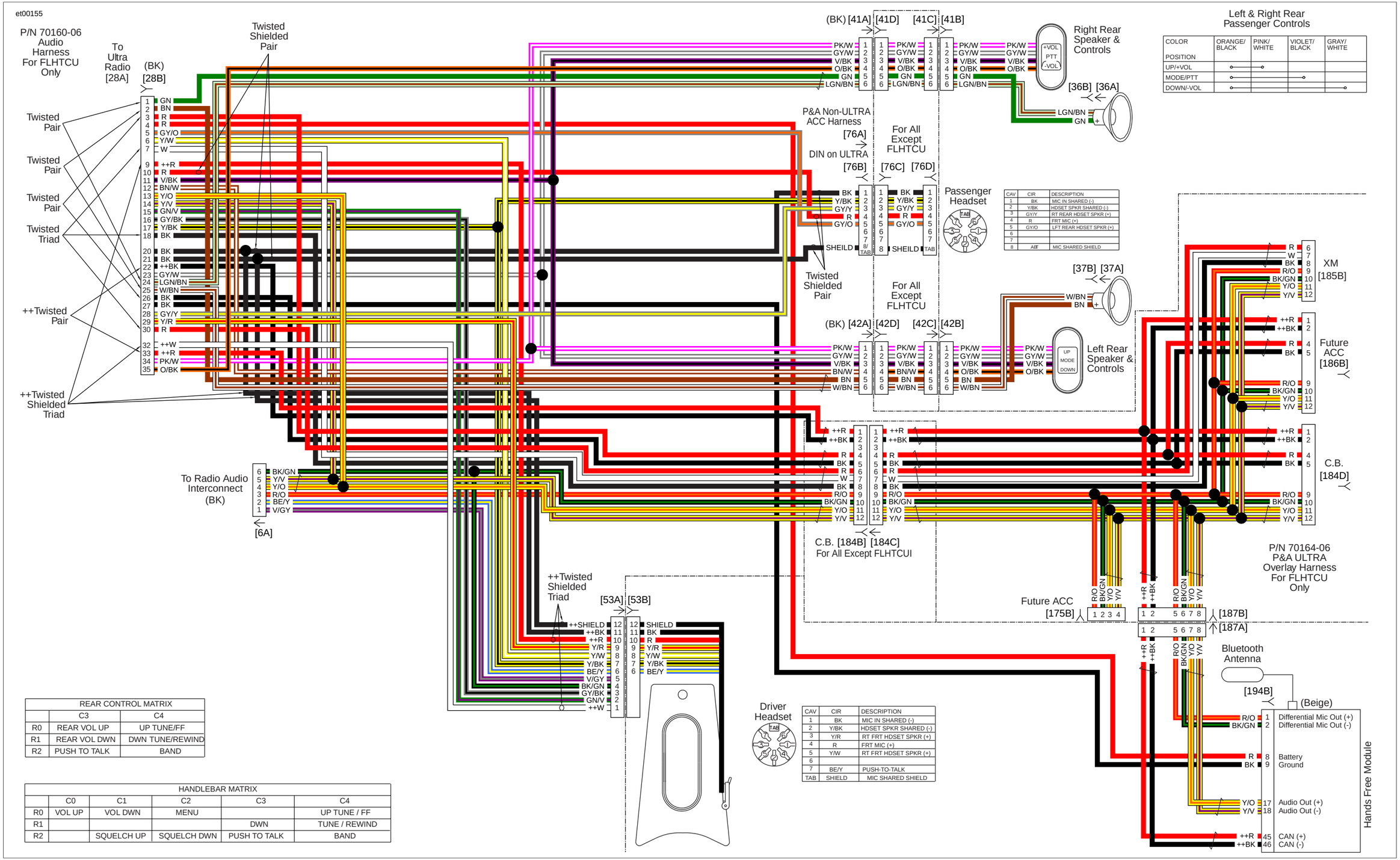


Figure B-30. 2009 Composite Ultra Audio Circuit

Figure B-30.
2009 Composite Ultra Audio Circuit

Figure B-30.
2009 Composite Ultra Audio Circuit

et00155



REAR CONTROL MATRIX

	C3	C4
R0	REAR VOL UP	UP TUNE/FF
R1	REAR VOL DWN	DWN TUNE/REWIND
R2	PUSH TO TALK	BAND

HANDLEBAR MATRIX

	C0	C1	C2	C3	C4
R0	VOL UP	VOL DWN	MENU		UP TUNE / FF
R1				DWN	TUNE / REWIND
R2		SQUELCH UP	SQUELCH DWN	PUSH TO TALK	BAND

Figure B-31. 2009 Ultra Audio Interconnect Harness

Figure B-31.
2009 Ultra Audio Interconnect Harness

Figure B-31.
2009 Ultra Audio Interconnect Harness

et00156

SWITCH POSITION	BROWN/ WHITE	PINK/ WHITE	VIOLET/ BLACK	GRAY/ WHITE
UP	X	X		
MODE	X			X
DOWN	X			X

SWITCH POSITION	VIOLET/ BLACK	GRAY/ GREEN	ORANGE/ BLACK	BROWN/ BLACK
+SQ UP (FORE)	X	X		
PTT (PUSH)	X		X	
-SQ DN (AFT)	X			X

SWITCH POSITION	PINK/ WHITE	GREEN/ BLUE	BROWN/ BLACK	GRAY/ GREEN
+VOL	X	X		
AUDIO	X		X	
-VOL	X			X

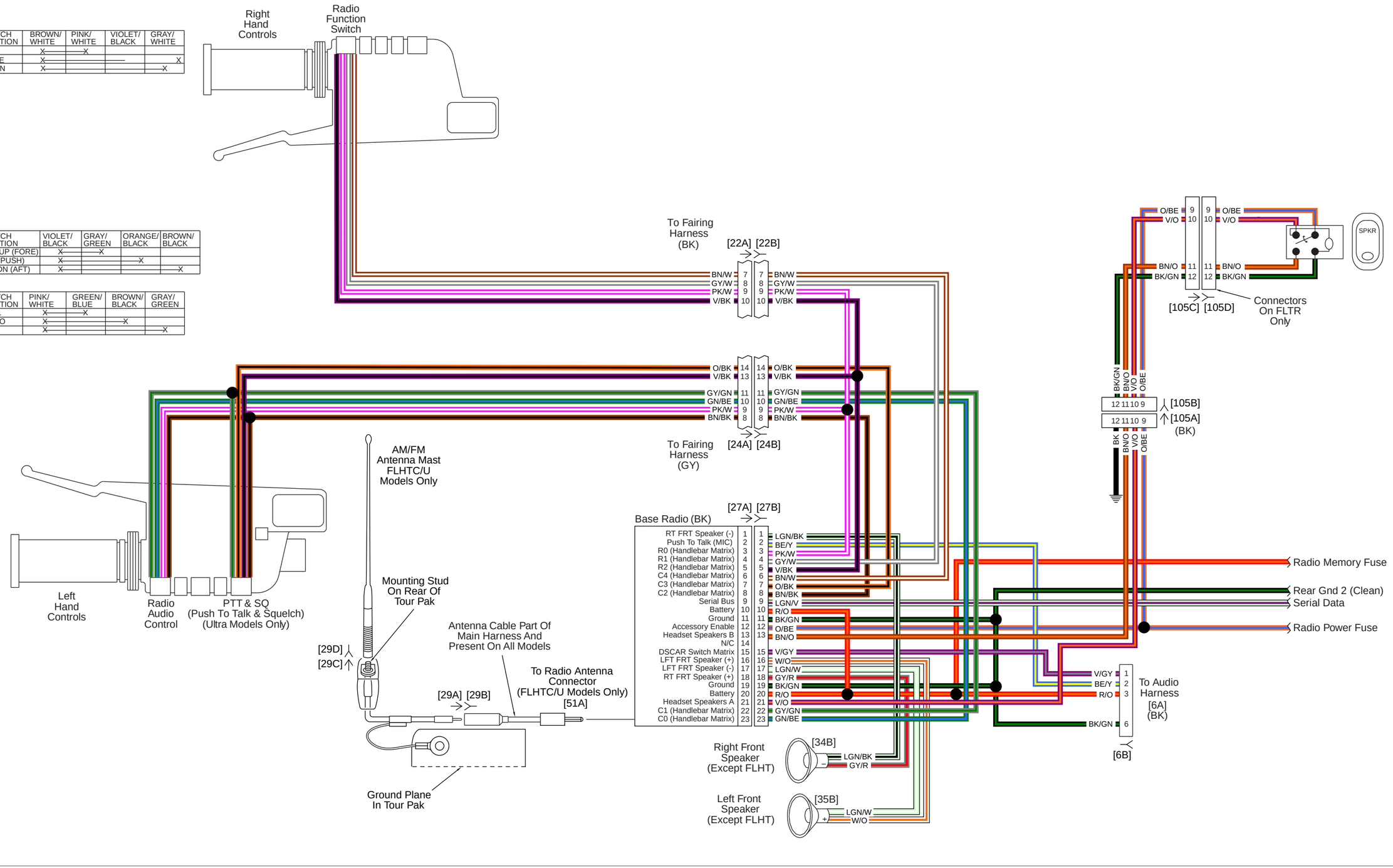


Figure B-32. 2009 Basic Radio Interconnect Circuit

Figure B-32.
2009 Basic Radio Interconnect Circuit

Figure B-32.
2009 Basic Radio Interconnect Circuit

et00174

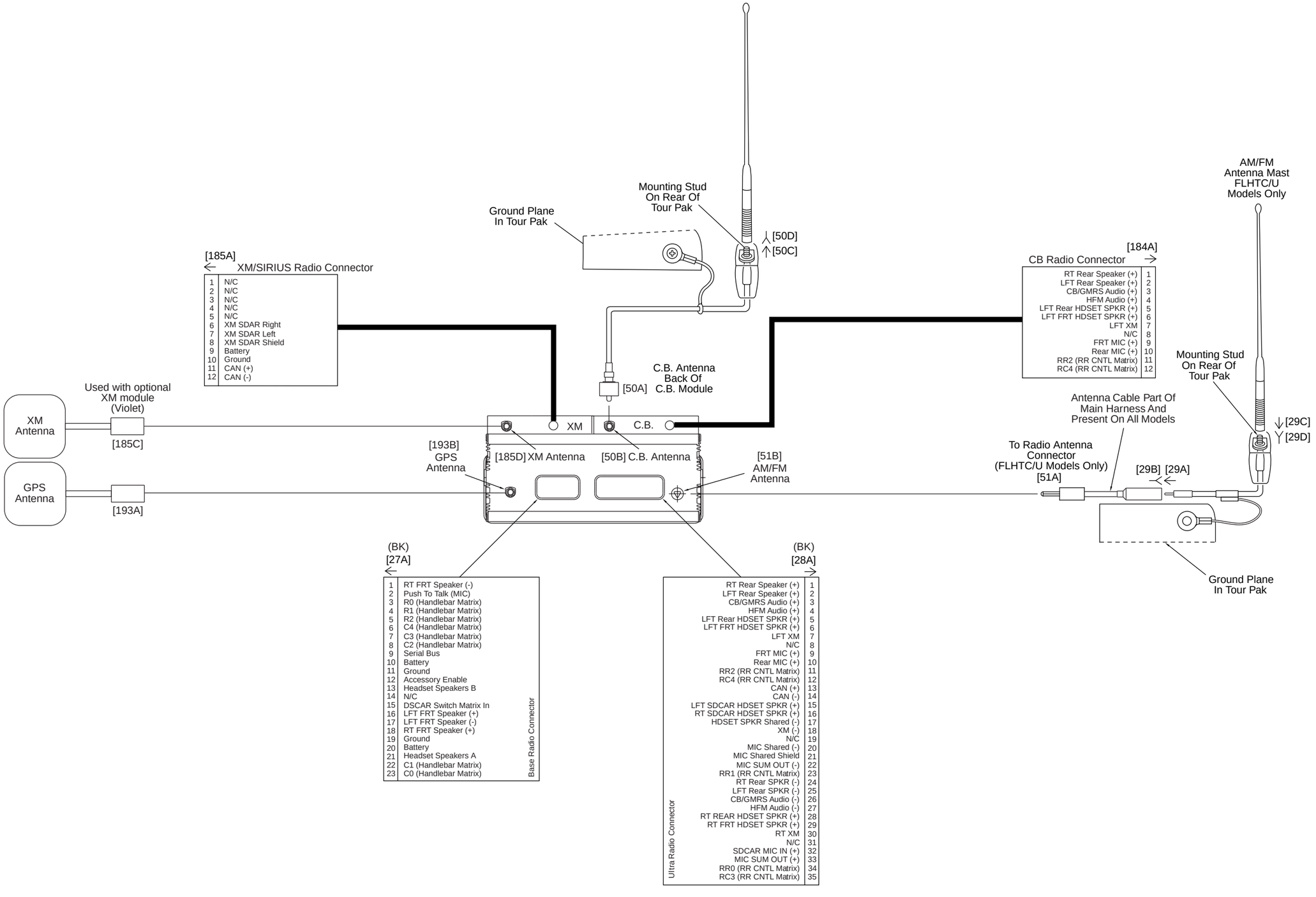


Figure B-33. 2009 Ultra Radio RF Interconnect Circuit

Figure B-33.
2009 Ultra Radio RF Interconnect Circuit

Figure B-33.
2009 Ultra Radio RF Interconnect Circuit

TABLE OF CONTENTS

SUBJECT **PAGE NO.**
C.1 ABS MODULE....C-1
C.2 WHEEL SPEED SENSORS....C-4
C.3 ABS BRAKE LINES....C-6

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

ABS MODULE C.1

REMOVAL

PART NUMBER	TOOL NAME
SNAP-ON BB200A	BASIC VACUUM BRAKE BLEEDER

NOTE

The ABS module consists of the hydraulic control unit (HCU) and the electronic control unit (ECU), which can be serviced separately.

Hydraulic Control Unit (HCU)

1. Remove right side saddlebag. See 2.29 SADDLEBAGS.
2. Remove right side cover.
3. Remove battery. See 1.17 BATTERY MAINTENANCE.

NOTE

For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool to drain the brake systems.

4. Drain brake systems.
5. Disconnect ABS module electrical connector.

NOTE

Wrap banjo fittings with pieces of shop towel to absorb leakage of residual brake fluid.

6. Remove four banjo bolts to release brake lines from ABS module. Discard sealing washers.

CAUTION

This device is sensitive to electrostatic discharge (ESD). Care must be taken to prevent exposure to ESD while handling the electronic control unit (ECU) alone or when mated to the hydraulic control unit (HCU). Always touch the motorcycle frame or a grounded surface before handling. (00588b)

7. See Figure C-1. Remove three fasteners (3) to release ABS module (2) from battery tray (1).
8. Remove ABS module from motorcycle.
9. Inspect three rubber mounts (5) for damage or deterioration. If replacement is necessary, proceed as follows:
 a. Remove bushing (4) from each side of rubber mount. Remove rubber mount from battery tray.
 b. Install **new** rubber mount. Install bushing in each side of rubber mount.
10. See Figure C-2. If necessary, remove four fasteners (4) to separate the HCU from the ECU.

Electrical Control Unit (ECU)

1. Remove battery. See 1.17 BATTERY MAINTENANCE.

NOTE

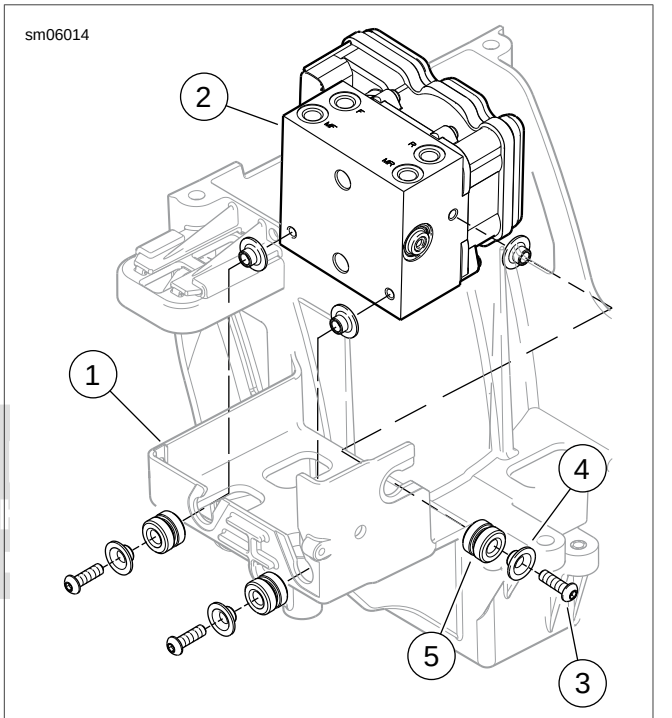
It is not necessary to remove the ABS module assembly to replace the ABS module ECU.

2. Disconnect ABS module electrical connector.

CAUTION

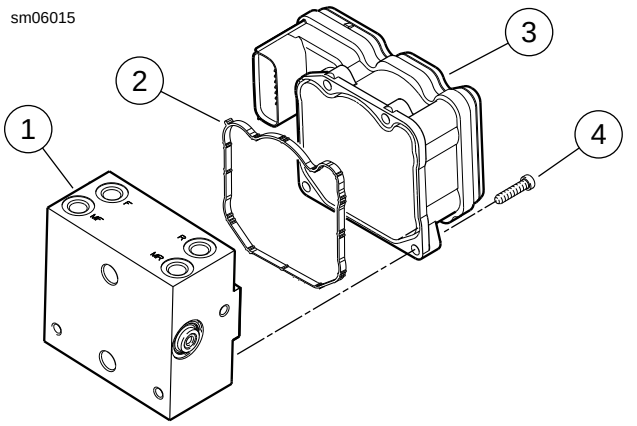
This device is sensitive to electrostatic discharge (ESD). Care must be taken to prevent exposure to ESD while handling the electronic control unit (ECU) alone or when mated to the hydraulic control unit (HCU). Always touch the motorcycle frame or a grounded surface before handling. (00588b)

3. See Figure C-2. Remove four fasteners (4) and separate ECU (3) from HCU (1).



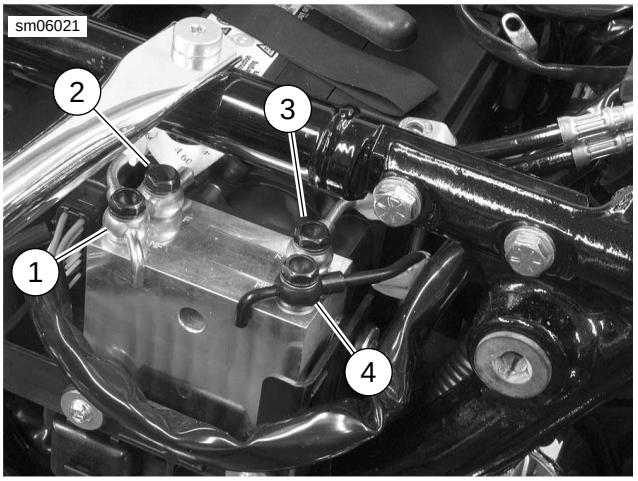
1. **Battery tray**
2. **ABS module**
3. **Fastener (3)**
4. **Bushing (6)**
5. **Rubber mount (3)**

Figure C-1. ABS Module



1. **Hydraulic control unit (HCU)**
2. **Gasket**
3. **Electrical control unit (ECU)**
4. **Fastener (4)**

Figure C-2. ABS Module Components



1. **Front master cylinder-to-ABS module line**
2. **ABS module-to-front caliper line**
3. **ABS module-to-rear caliper line**
4. **Rear master cylinder-to-ABS module line**

Figure C-3. ABS Module Connections

INSTALLATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II
SNAP-ON BB200A	BASIC VACUUM BRAKE BLEEDER

ABS Module

CAUTION

This device is sensitive to electrostatic discharge (ESD). Care must be taken to prevent exposure to ESD while handling the electronic control unit (ECU) alone or when mated to the hydraulic control unit (HCU). Always touch the motorcycle frame or a grounded surface before handling. (00588b)

1. See Figure C-1. Position ABS module (2) on battery tray (1).
2. Install three fasteners (3) and tighten to 39-60 **in-lbs** (4.4-6.8 Nm).
3. See Figure C-3. Install banjo fittings to their respective ports on the ABS module using **new** sealing washers. Be sure to route banjo fitting of brake line to front brake calipers beneath brake line from front master cylinder.
4. Tighten banjo bolts to 12.5-14.5 ft-lbs (16.9-19.7 Nm).
5. Connect ABS module electrical connector.
6. Install battery. See 1.17 BATTERY MAINTENANCE.
7. If a **new** ABS module assembly or ABS module ECU were installed, program the ECU using DIGITAL TECHNICIAN II (Part No. HD-48650).

WARNING

Any time the ABS module, either master cylinder, or any line between a master cylinder and the ABS module is disconnected or replaced, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to do so could result in air in the hydraulic brake system, reducing brake efficiency, which could result in death or serious injury. (00585b)

8. Fill and bleed brake systems. See 1.16 BLEEDING BRAKES.

NOTE

For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool.

9. To confirm that brake systems are properly connected and air is completely purged, install master cylinder reservoir covers, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure.
10. Install right side cover.
11. Install right side saddlebag. See 2.29 SADDLEBAGS.

⚠WARNING

After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

12. Operate motorcycle at low speeds and verify braking systems operate properly.

Electrical Control Unit (ECU)

CAUTION

This device is sensitive to electrostatic discharge (ESD). Care must be taken to prevent exposure to ESD while handling the electronic control unit (ECU) alone or when mated to the hydraulic control unit (HCU). Always touch the motorcycle frame or a grounded surface before handling. (00588b)

1. See Figure C-2. Install gasket (2) to ECU (3).
2. Secure ECU to HCU using four fasteners (4). Tighten fasteners to 35-45 **in-lbs** (4.0-5.1 Nm).
3. Install ABS module if removed. See C.1 ABS MODULE, Installation.
4. Install battery. See 1.17 BATTERY MAINTENANCE.
5. If a **new** ABS module ECU was installed, program the ECU using DIGITAL TECHNICIAN II (Part No. HD-48650).

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

WHEEL SPEED SENSORS C.2

FRONT WHEEL SPEED SENSOR

Removal

1. **FLHR/C, FLHX, FLHT/C/U:** Turn front wheel to right fork stop. Reach under headlamp nacelle (FLHR/C) or fairing cap (FLHX, FLHT/C/U) on left side of steering head and disconnect front wheel speed sensor connector. Draw connector down through opening.
2. **FLTR:** Turn front wheel to right fork stop. Gently pull cable to draw front wheel speed sensor connector out left side of fairing bracket. Disconnect connector.
3. Cut cable straps to release front wheel speed sensor cable from brake hose.
4. See Figure C-4. Release front wheel speed sensor cable from clip as follows:
 a. Push on lip (1) at rear of clip to disengage from bracket. Rotate tab (2) (stamped ABS) rearward until clip is perpendicular to bracket and remove cable.

 NOTE

 If clip is not installed as described below, tab can slip out of slot in bracket. If this occurs, remove caliper mounting screws to release bracket from fork slider and then install tab in slot. Install bracket and tighten screws to 28-38 ft-lbs (37.9-51.5 Nm).

 b. Rotate tab (2) forward until clip is aligned with bracket and apply pressure to tab until lip (1) engages.
5. Retract axle until front wheel speed sensor is free. See 2.4 FRONT WHEEL.

NOTE

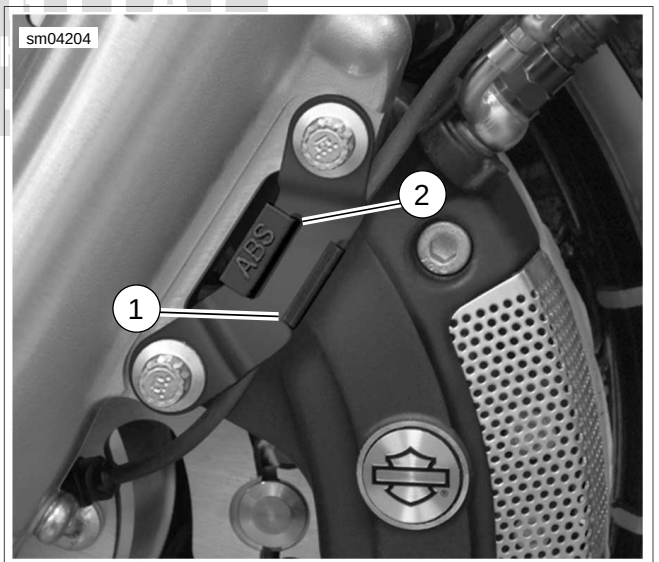
The wheel speed sensor works in conjunction with the ABS encoder bearing installed in the wheel hub. If necessary, see 2.11 SEALED WHEEL BEARINGS for removal and installation instructions.

Installation

NOTES

- *Always keep the wheel speed sensor away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur. Never pull wheel speed sensor cable taut or use to retain wheel, axle or other components.*
- *Install wheel speed sensor with index pin on the out-board side or sensor will be damaged during installation.*

1. Push axle through **new** front wheel speed sensor and left fork slider.
2. Secure front wheel. See 2.4 FRONT WHEEL. Be sure to rotate front wheel speed sensor until index pin makes contact with shoulder on fork slider as shown in Figure C-5.
3. Route wheel speed sensor cable up to lower fork bracket following brake hose.
4. **FLHR/C, FLHX, FLHT/C/U:** Turn front wheel to right fork stop. Feed connector up through opening in front of lower fork bracket and connect to socket housing.
5. **FLTR:** Turn front wheel to right fork stop. Connect front wheel speed sensor connector and feed connector under main harness conduit into left side of fairing bracket.
6. Secure the sensor cable and fender tip lamp wires using three **new** cable straps as follows:
 a. On the brake hose lower crimp capturing front wheel speed sensor cable and brake hose.
 b. Approximately midway between the upper and lower brake hose crimps capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.
 c. Approximately 2.5 in. (63.5 mm) below the brake hose upper crimp capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.
7. See Figure C-4. Install front wheel speed sensor cable in clip as follows:
 a. Push on lip (1) at rear of clip to disengage from bracket. Rotate tab (2) (stamped ABS) rearward until clip (1) is perpendicular to bracket and install cable.
 b. Rotate tab (2) forward and apply pressure until lip (1) engages. Gently tug on cable to verify that clip is properly installed.



1. Push lip to disengage
2. Push tab to engage

Figure C-4. Front Wheel Speed Sensor Cable Clip

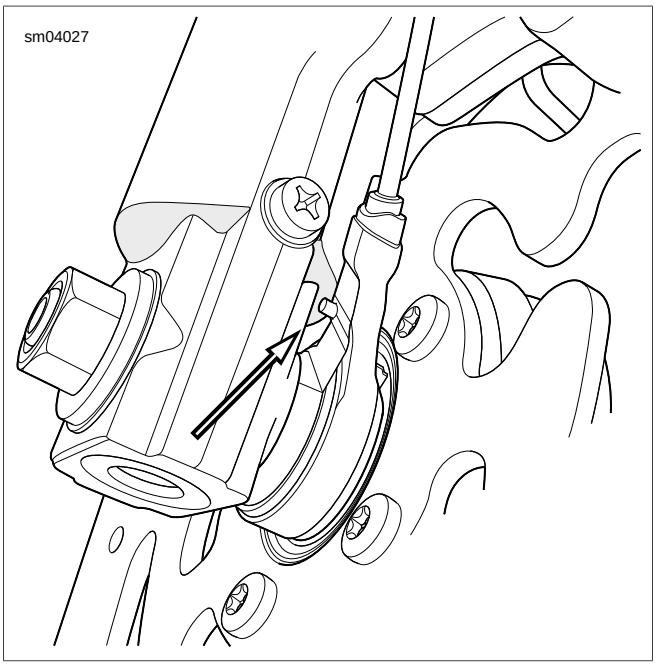


Figure C-5. Front Wheel Speed Sensor Index Pin

REAR WHEEL SPEED SENSOR

Removal

1. Remove right saddlebag. See 2.29 SADDLEBAGS.
2. Remove right side cover.
3. Release rear wheel speed sensor connector from anchor on right side battery tray. Disconnect connector.
4. Rear wheel speed sensor cable and rear brake hose are secured to the rear fork with two cable retainers. The sensor cable is additionally secured to the brake hose with a conduit clip. Free rear wheel speed sensor cable from all three.
5. Retract axle until rear wheel speed sensor is free. See 2.5 REAR WHEEL.

NOTE

The wheel speed sensor works in conjunction with the ABS encoder bearing installed in the wheel hub. If necessary, see 2.11 SEALED WHEEL BEARINGS for removal and installation instructions.

Installation

NOTES

- *Always keep the wheel speed sensor away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur. Never pull wheel speed sensor cable taut or use to retain wheel, axle or other components.*
- *Install wheel speed sensor with index pin on the out-board side or sensor will be damaged during installation.*

1. See Figure C-6. Hold **new** rear wheel speed sensor in place with index pin outboard toward rear fork, and push axle through sensor, caliper bracket and right side of rear fork.
2. Secure rear wheel. See 2.5 REAR WHEEL. Rotate rear wheel speed sensor until index pin makes contact with caliper bracket at point shown in Figure C-6.
3. Route rear wheel speed sensor cable forward along top of rear fork.
4. Capture rear wheel speed sensor cable and brake hose in rear cable clips on top of rear fork. Secure cable to brake hose with conduit clip placed 1.25 in. (31.8 mm) ahead of the rear brake hose crimp.
5. Route cable to outboard right side of battery caddy. Connect pin and socket housings and secure to anchor.
6. Install right side cover.
7. Install right saddlebag. See 2.29 SADDLEBAGS.

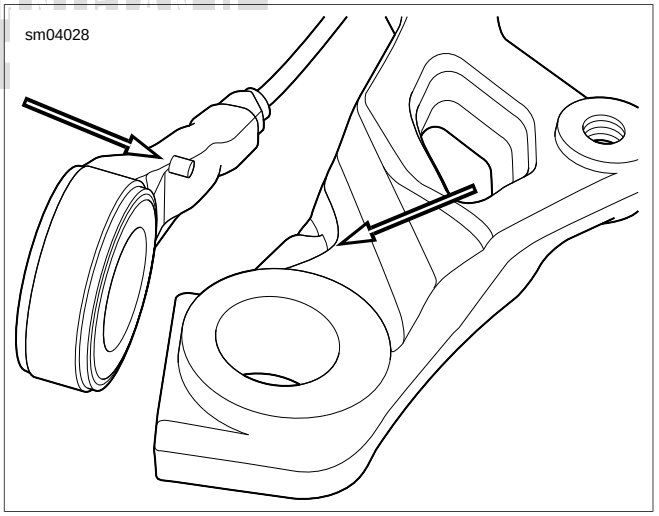


Figure C-6. Rear Wheel Speed Sensor Index Pin

ABS BRAKE LINES C.3

FRONT MASTER CYLINDER TO ABS MODULE

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

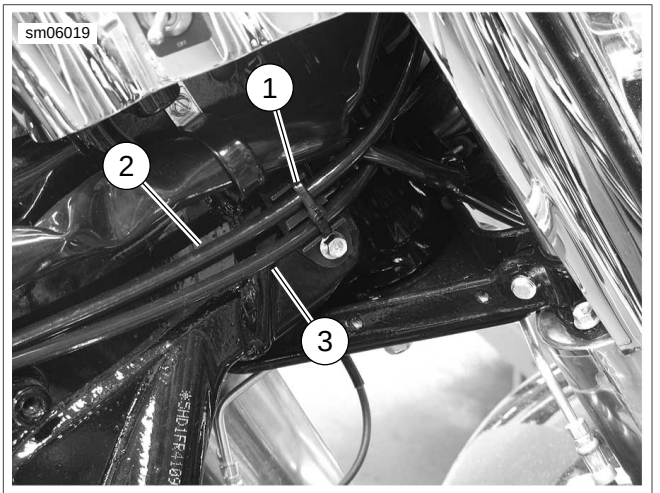
Removal

1. Remove right side saddlebag. See 2.29 SADDLEBAGS.
2. Remove right side cover.
3. Remove fuel tank. See 4.5 FUEL TANK.
4. Remove top caddy. See 7.7 ELECTRICAL CADDIES.
5. **FLHR/C:** Remove right side headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
6. **FLHX, FLHT/C/U:** Remove outer fairing and fairing cap. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 2.38 FAIRING CAP: FLHX, FLHT/C/U, respectively.
7. **FLTR:** Remove bezel. See 2.42 INSTRUMENT BEZEL: FLTR.
8. Cut cable strap to release brake line from right handlebar riser or right handlebar.
9. See Figure C-7. Cut cable strap (1) to release brake lines (2, 3) from brake line bracket at right side of steering head.
10. See Figure C-8. Release brake lines (2, 3) from wire trough (1).

NOTE

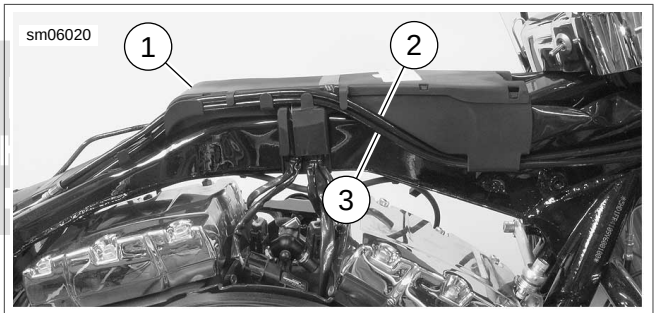
Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.

11. See Figure C-9. Remove banjo bolt to release brake line (1) from MF port of ABS module. Discard sealing washers.
12. Remove cover from master cylinder reservoir.
13. Remove banjo bolt to release brake line from master cylinder reservoir. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard sealing washers.
14. Remove brake line from motorcycle.



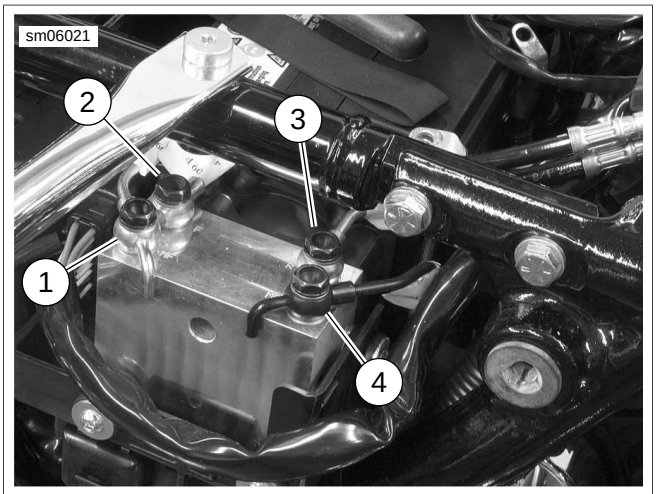
1. **Cable strap**
2. **Front master cylinder-to-ABS module line**
3. **ABS module-to-front caliper line**

Figure C-7. Brake Line Bracket



1. **Wire trough**
2. **Front master cylinder-to-ABS module line**
3. **ABS module-to-front caliper line**

Figure C-8. Brake Line Routing



1. **Front master cylinder-to-ABS module line**
2. **ABS module-to-front caliper line**
3. **ABS module-to-rear caliper line**
4. **Rear master cylinder-to-ABS module line**

Figure C-9. ABS Module Connections

Installation

1. Position brake line along right side of wire trough with rear banjo fitting adjacent to ABS module.
2. Feed front section of brake line forward along right side of steering head, past upper fork bracket, and to master cylinder.
3. Start banjo bolt with **new** sealing washers to secure brake line to master cylinder.
4. Start banjo bolt with **new** sealing washers to secure brake line to MF port of ABS module.
5. Secure brake line as follows:
 a. **FLHR/C, FLTR:** Loosely install **new** cable strap to secure handlebar switch harness and brake hose to right handlebar riser.
 b. **FLHX, FLHT/C/U:** Install **new** cable strap 2.5 in. (63.5 mm) rear of fairing cap opening to secure handlebar switch harness and brake line to right handlebar.
6. See Figure C-7. Be sure lines are routed as shown and secure with **new** cable strap (1) to brake line bracket at right side of steering head.

NOTE

*If installing **new** brake line bracket, tighten flange screw to 20-30 **in-lbs** (2.3-3.4 Nm).*

7. See Figure C-8. Secure brake lines to wire trough.
8. Tighten master cylinder banjo bolt to 12.5-14.5 ft-lbs (16.9-19.7 Nm).
9. Tighten ABS module banjo bolt to 12.5-14.5 ft-lbs (16.9-19.7 Nm).

⚠WARNING

Any time the ABS module, either master cylinder, or any line between a master cylinder and the ABS module is disconnected or replaced, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to do so could result in air in the hydraulic brake system, reducing brake efficiency, which could result in death or serious injury. (00585b)

10. Fill and bleed brake system. See 1.16 BLEEDING BRAKES.
11. To confirm that brake system is properly connected and that all air is purged, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure.
12. **FLHR/C:** Install right side headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
13. **FLHX, FLHT/C/U:** Install outer fairing and fairing cap. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 2.38 FAIRING CAP: FLHX, FLHT/C/U, respectively.
14. **FLTR:** Install bezel. See 2.42 INSTRUMENT BEZEL: FLTR.
15. Install top caddy. See 7.7 ELECTRICAL CADDIES.
16. Install fuel tank. See 4.5 FUEL TANK.
17. Install right side cover.
18. Install right saddlebag. See 2.29 SADDLEBAGS.

ABS MODULE TO FRONT BRAKE CALIPERS

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Removal

1. Remove right side saddlebag. See 2.29 SADDLEBAGS.
2. Remove right side cover.
3. Remove fuel tank. See 4.5 FUEL TANK.
4. Remove top caddy. See 7.7 ELECTRICAL CADDIES.
5. **FLHR/C:** Remove left side headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
6. **FLHX, FLHT/C/U:**
 a. Remove outer fairing and fairing cap. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 2.38 FAIRING CAP: FLHX, FLHT/C/U, respectively.
 b. Remove front turn signal lamps (FLHX) or auxiliary lamps (FLHT/C/U). See 7.16 TURN SIGNAL LAMPS or 7.13 AUXILIARY LAMPS AND BRACKETS.
 c. Remove chrome skirt.
7. **FLTR:** No disassembly required.

8. Cut three cable straps to release front wheel speed sensor cable and front fender tip lamp wires (if equipped) from left caliper brake hose.
9. Cut cable strap to release brake line from right handlebar riser or right handlebar.
10. See Figure C-7. Cut cable strap (1) to release brake lines (2, 3) from brake line bracket at right side of steering head.
11. Remove fastener securing front brake lines to the lower fork bracket.

NOTE

Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.

12. See Figure C-9. Remove banjo bolt to release brake line (2) from F port of ABS module. Discard sealing washers.
13. Remove banjo bleeder bolts to release brake lines to calipers. Discard sealing washers.
14. Pull brake line forward to remove from motorcycle.

Installation

1. Feed brake line rearward below lower fork bracket and along right side of steering head and wire trough.
2. Secure caliper brake lines to lower fork bracket. Verify that brake lines are equal distance from the left and right fork sliders and tighten fastener to 120-180 **in-lbs** (13.6-20.3 Nm).
3. Start banjo bleeder bolts with **new** sealing washers to secure brake lines to calipers.
4. See Figure C-9. Route banjo fitting (2) under brake line (1) and start banjo bolt with **new** sealing washers to secure brake line to F port of ABS module.
5. Secure brake line as follows:
 a. **FLHR/C, FLTR:** Loosely install **new** cable strap to secure handlebar switch harness and brake hose to right handlebar riser.
 b. **FLHX, FLHT/C/U:** Install **new** cable strap 2.5 in. (63.5 mm) rear of fairing cap opening to secure handlebar switch harness and brake line to right handlebar.
6. See Figure C-7. Route lines as shown and secure with **new** cable strap (1) to brake line bracket at right side of steering head.

NOTE

*If installing **new** brake line bracket, tighten flange screw to 20-30 **in-lbs** (2.3-3.4 Nm).*

7. See Figure C-8. Secure brake lines to wire trough.
8. Tighten caliper banjo bleeder bolts to 17-19 ft-lbs (23.1-25.8 Nm).
9. Tighten ABS module banjo bolt to 12.5-14.5 ft-lbs (16.9-19.7 Nm).
10. Secure the sensor cable and fender tip lamp wires using three **new** cable straps as follows:
 a. On the brake hose lower crimp capturing front wheel speed sensor cable and brake hose.
 b. Approximately midway between the upper and lower brake hose crimps capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.
 c. Approximately 2.5 in. (63.5 mm) below the brake hose upper crimp capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.
11. Fill and bleed brake system. See 1.16 BLEEDING BRAKES.
12. To confirm that brake system is properly connected and that all air is purged, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure.
13. **FLHR/C:** Install left side headlamp nacelle. See 2.47 HEADLAMP NACELLE: FLHR/C.
14. **FLHX, FLHT/C/U:**
 a. Install chrome skirt. Do not capture brake line between chrome skirt and front of steering head, as it may become pinched or kinked when handlebar is turned. Route brake line above chrome skirt as shown in Figure C-10.
 b. Install front turn signal lamps (FLHX) or auxiliary lamps (FLHT/C/U). See 7.16 TURN SIGNAL LAMPS or 7.13 AUXILIARY LAMPS AND BRACKETS.
 c. Install outer fairing and fairing cap. See 2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 2.38 FAIRING CAP: FLHX, FLHT/C/U, respectively.
15. Install top caddy. See 7.7 ELECTRICAL CADDIES.
16. Install fuel tank. See 4.5 FUEL TANK.
17. Install right side cover.
18. Install right side saddlebag. See 2.29 SADDLEBAGS.



Figure C-10. Route Brake Line to Front Calipers Above Chrome Skirt

REAR MASTER CYLINDER TO ABS MODULE

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Removal

1. Remove right side saddlebag. See 2.29 SADDLEBAGS.
2. Remove right side cover.
3. Remove right side rider footboard. See 2.52 FOOTBOARDS AND FOOTRESTS.
4. See Figure C-12. Free brake line from electrical harness conduit clips (6).
5. Remove terminals from rear brake light switch (4).
6. Remove fastener (5) securing brake light switch bracket to frame.
7. Remove cable strap near middle frame downtube.

NOTE

Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.

8. See Figure C-11. Remove banjo bolt (4) to release brake line from MR port of ABS module. Discard sealing washers.
9. See Figure C-12. Remove socket terminals from rear brake light switch (4). Cut cable strap to free rear brake light switch wires from lower frame tube, if necessary.
10. Remove fastener (5).
11. Stand motorcycle upright so rear master cylinder reservoir is level.

NOTE

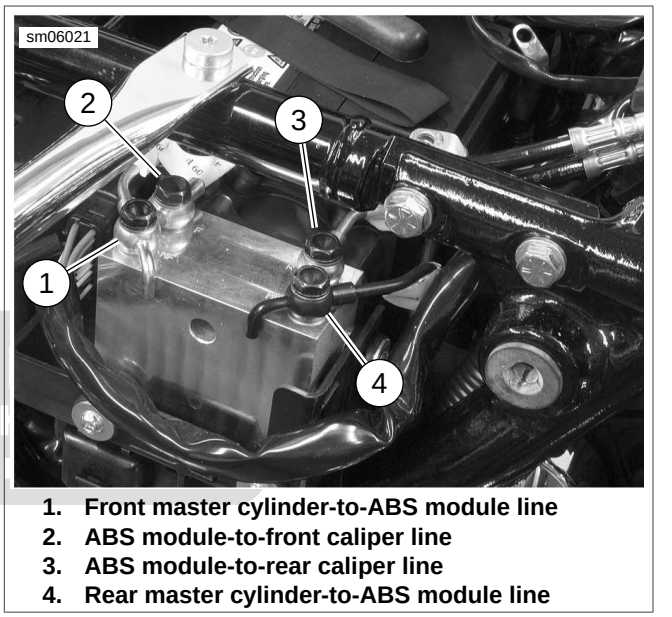
To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.

12. Remove cover from master cylinder reservoir.

NOTE

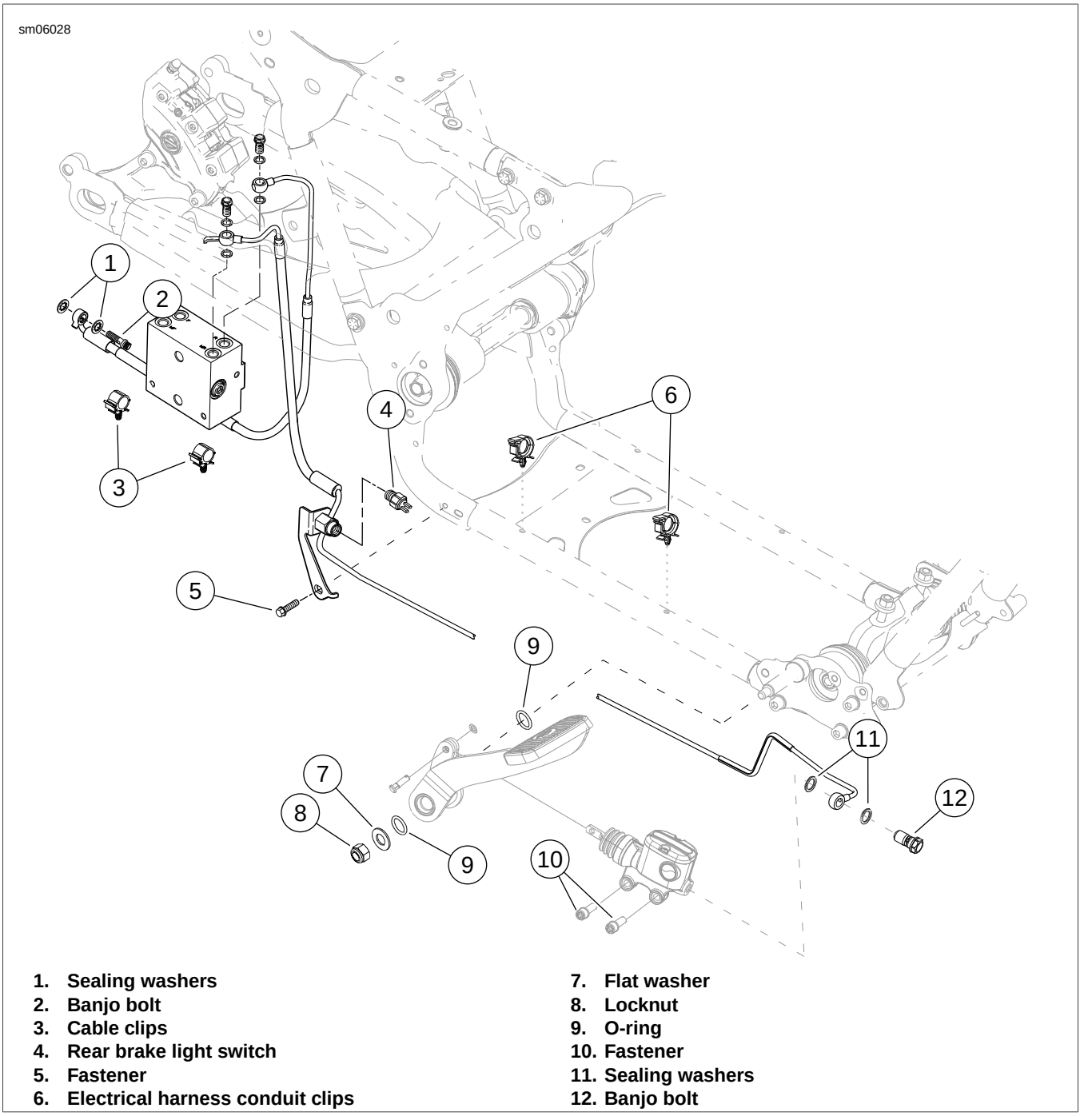
Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.

13. Remove banjo bolt (12) from master cylinder reservoir. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard sealing washers (11).
14. Using a clean shop cloth, wipe out any remaining fluid in the master cylinder reservoir.
15. Remove screws (10) securing master cylinder to frame.
16. Remove locknut (8) with flat washer (7) and pull brake pedal/master cylinder assembly from pedal shaft. Remove and discard O-rings (9).
17. Remove brake line from motorcycle.



1. **Front master cylinder-to-ABS module line**
2. **ABS module-to-front caliper line**
3. **ABS module-to-rear caliper line**
4. **Rear master cylinder-to-ABS module line**

Figure C-11. ABS Module Connections



1. **Sealing washers**
2. **Banjo bolt**
3. **Cable clips**
4. **Rear brake light switch**
5. **Fastener**
6. **Electrical harness conduit clips**
7. **Flat washer**
8. **Locknut**
9. **O-ring**
10. **Fastener**
11. **Sealing washers**
12. **Banjo bolt**

Figure C-12. Rear ABS Brake Line Assembly

Installation

1. Place rear brake line into approximate position along top of lower right frame tube. From area of brake lamp switch, feed brake line hose upward, inboard of downtube and toward ABS module.
2. See Figure C-11. Start banjo bolt with new sealing washers to secure brake line (4) to MR port of ABS module.

NOTE

*If installing **new** rear brake light switch, apply Loctite Pipe Sealant with Teflon 565 to threads and start switch into rear brake line. Using flats on switch, tighten to 12-15 ft-lbs (16.3-20.3 Nm).*

3. See Figure C-12. Align locating tab on brake light switch bracket with slot in frame. Install fastener (5) and tighten to 80-100 **in-lbs** (9.0-11.3 Nm).
4. Connect terminals onto rear brake light switch (4). If removed, install **new** cable strap to secure rear brake light switch wires.
5. Capture rear brake line to electrical harness conduit clips (6).

6. Apply a light coat of Wheel Bearing Grease (HD Part No. 99855-89) to the brake pedal shaft and bore. Install **new** O-rings (9) on each side of bore.
7. Install brake pedal/master cylinder assembly on the pedal shaft. Install flat washer (7) and **new** locknut (8) on pedal shaft.
8. Fasten master cylinder to frame. Tighten screws (10) to 126-150 **in-lbs** (14.2-17.0 Nm).
9. Tighten brake pedal shaft locknut (8) to 15-20 ft-lbs (20-27 Nm).
10. Secure brake line to master cylinder reservoir using new sealing washers. Tighten banjo bolt (12) to 12.5-14.5 ft-lbs (17.0-19.7 Nm).
11. Tighten banjo bolt to ABS module to 12.5-14.5 ft-lbs (16.9-19.7 Nm).

⚠WARNING

Any time the ABS module, either master cylinder, or any line between a master cylinder and the ABS module is disconnected or replaced, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to do so could result in air in the hydraulic brake system, reducing brake efficiency, which could result in death or serious injury. (00585b)

12. Fill and bleed brake system. See 1.16 BLEEDING BRAKES.
13. To confirm that brake system is properly connected and all air is purged, install master cylinder reservoir cover, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure in the "Toolbox" menu.
14. Install right side rider footboard. See 2.52 FOOTBOARDS AND FOOTRESTS.
15. Install right side cover.
16. Install right side saddlebag. See 2.29 SADDLEBAGS.

ABS MODULE TO REAR BRAKE CALIPER

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Removal

1. Remove right side saddlebag. See 2.29 SADDLEBAGS.
2. Remove right side cover.
3. See Figure C-12. Free rear brake line hose from cable clips (3) on rear fork.
4. Remove conduit clip securing rear wheel speed sensor cable to brake hose.

NOTE

Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.

5. See Figure C-11. Remove banjo bolt to release brake line (3) from R port of ABS module. Discard sealing washers.
6. See Figure C-12. Remove banjo bolt (2) from rear brake caliper. Discard sealing washers (1).
7. Remove brake line from channel on front of battery tray.
8. Remove brake line from motorcycle.

Installation

1. Place rear brake line into approximate position along top of rear fork and up toward ABS module. Secure brake line into channel on front of battery tray.
2. See Figure C-12. Capture rear brake line hose in two cable clips (3) on rear fork.
3. See Figure C-11. Install banjo bolt (3) with **new** sealing washers and tighten to 12.5-14.5 ft-lbs (16.9-19.7 Nm).
4. See Figure C-12. Install banjo bolt (2) with **new** sealing washers and tighten to 17-19 ft-lbs (23.1-25.8 Nm).
5. Install **new** conduit clip 1.25 in. (31.8 mm) in front of the rear brake hose crimp capturing rear wheel speed sensor cable to brake hose.
6. Fill and bleed brake system. See 1.16 BLEEDING BRAKES.
7. To confirm that brake system is properly connected and all air is purged, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure.
8. Install right side cover.
9. Install right side saddlebag. See 2.29 SADDLEBAGS.

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METRIC CONVERSION D.1

CONVERSION TABLE

Table D-1. Metric Conversions

MILLIMETERS to INCHES (MM x 0.03937 = IN)								INCHES to MILLIMETERS (IN x 25.40 = MM)							
mm	in	mm	in	mm	in	mm	in	in	mm	in	mm	in	mm	in	mm
.1	.0039	25	.9842	58	2.283	91	3.582	.001	.025	.6	15.240	1-15/16	49.21	3-5/16	84.14
.2	.0078	26	1.024	59	2.323	92	3.622	.002	.051	5/8	15.875	2	50.80	3-3/8	85.72
.3	.0118	27	1.063	60	2.362	93	3.661	.003	.076	11/16	17.462	2-1/16	52.39	3.4	86.36
.4	.0157	28	1.102	61	2.401	94	3.701	.004	.102	.7	17.780	2.1	53.34	3-7/16	87.31
.5	.0197	29	1.142	62	2.441	95	3.740	.005	.127	3/4	19.050	2-1/8	53.97	3-1/2	88.90
.6	.0236	30	1.181	63	2.480	96	3.779	.006	.152	.8	20.320	2-3/16	55.56	3-9/16	90.49
.7	.0275	31	1.220	64	2.519	97	3.819	.007	.178	13/16	20.638	2.2	55.88	3.6	91.44
.8	.0315	32	1.260	65	2.559	98	3.858	.008	.203	7/8	22.225	2-1/4	57.15	3-5/8	92.07
.9	.0354	33	1.299	66	2.598	99	3.897	.009	.229	.9	22.860	2.3	58.42	3-11/16	93.66
1	.0394	34	1.338	67	2.638	100	3.937	.010	.254	15/16	23.812	2-5/16	58.74	3.7	93.98
2	.0787	35	1.378	68	2.677	101	3.976	1/64	.397	1	25.40	2-3/8	60.32	3-3/4	95.25
3	.1181	36	1.417	69	2.716	102	4.016	.020	.508	1-1/16	26.99	2.4	60.96	3.8	96.52
4	.1575	37	1.456	70	2.756	103	4.055	.030	.762	1.1	27.94	2-7/16	61.91	3-13/16	96.84
5	.1968	38	1.496	71	2.795	104	4.094	1/32	.794	1-1/8	28.57	2-1/2	63.50	3-7/8	98.42
6	.2362	39	1.535	72	2.834	105	4.134	.040	1.016	1-3/16	30.16	2-9/16	65.09	3.9	99.06
7	.2756	40	1.575	73	2.874	106	4.173	.050	1.270	1.2	30.48	2.6	66.04	3-15/16	100.01
8	.3149	41	1.614	74	2.913	107	4.212	.060	1.524	1-1/4	31.75	2-5/8	66.67	4	101.6
9	.3543	42	1.653	75	2.953	108	4.252	1/16	1.588	1.3	33.02	2-11/16	68.26	4-1/16	102.19
10	.3937	43	1.693	76	2.992	109	4.291	.070	1.778	1-5/16	33.34	2.7	68.58	4.1	104.14
11	.4331	44	1.732	77	3.031	110	4.331	.080	2.032	1-3/8	34.92	2-3/4	69.85	4-1/8	104.77
12	.4724	45	1.772	78	3.071	111	4.370	.090	2.286	1.4	35.56	2.8	71.12	4-3/16	106.36
13	.5118	46	1.811	79	3.110	112	4.409	.1	2.540	1-7/16	36.51	2-13/16	71.44	4.2	106.68
14	.5512	47	1.850	80	3.149	113	4.449	1/8	3.175	1-1/2	38.10	2-7/8	73.02	4-1/4	107.95
15	.5905	48	1.890	81	3.189	114	4.488	3/16	4.762	1-9/16	39.69	2.9	73.66	4.3	109.22
16	.6299	49	1.929	82	3.228	115	4.527	.2	5.080	1.6	40.64	2-15/16	74.61	4-5/16	109.54
17	.6693	50	1.968	83	3.268	116	4.567	1/4	6.350	1-5/8	41.27	3	76.20	4-3/8	111.12
18	.7086	51	2.008	84	3.307	117	4.606	.3	7.620	1-11/16	42.86	3-1/16	77.79	4.4	111.76
19	.7480	52	2.047	85	3.346	118	4.645	5/16	7.938	1.7	43.18	3.1	78.74	4-7/16	112.71
20	.7874	53	2.086	86	3.386	119	4.685	3/8	9.525	1-3/4	44.45	3-1/8	79.37	4-1/2	114.30
21	.8268	54	2.126	87	3.425	120	4.724	.4	10.160	1.8	45.72	3-3/16	80.96	4-9/16	115.89
22	.8661	55	2.165	88	3.464	121	4.764	7/16	11.112	1-13/16	46.04	3.2	81.28	4.6	116.84
23	.9055	56	2.205	89	3.504	122	4.803	1/2	12.700	1-7/8	47.62	3-1/4	82.55	4-5/8	117.47
24	.9449	57	2.244	90	3.543	123	4.842	9/16	14.288	1.9	48.26	3.3	83.82	4-11/16	119.06

FLUID CONVERSIONS D.2

UNITED STATES SYSTEM

Unless otherwise specified, all fluid volume measurements in this Service Manual are expressed in United States (U.S.) units-of-measure. See below:

- 1 pint (U.S.) = 16 fluid ounces (U.S.)
- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.) = 4 quarts (U.S.) = 128 fl. oz. (U.S.)

METRIC SYSTEM

Fluid volume measurements in this Service Manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). Should you need to convert from U.S. units-of-measure to metric units-of-measure (or vice versa), refer to the following:

- fluid ounces (U.S.) x 29.574 = milliliters
- pints (U.S.) x 0.473 = liters
- quarts (U.S.) x 0.946 = liters
- gallons (U.S.) x 3.785 = liters
- milliliters x 0.0338 = fluid ounces (U.S.)
- liters x 2.114 = pints (U.S.)
- liters x 1.057 = quarts (U.S.)
- liters x 0.264 = gallons (U.S.)

BRITISH IMPERIAL SYSTEM

Fluid volume measurements in this Service Manual do not include the British Imperial (Imp.) system equivalents. The following conversions exist in the British Imperial system:

- 1 pint (Imp.) = 20 fluid ounces (Imp.)
- 1 quart (Imp.) = 2 pints (Imp.)
- 1 gallon (Imp.) = 4 quarts (Imp.)

Although the same unit-of-measure terminology as the U.S. system is used in the British Imperial (Imp.) system, the actual volume of each British Imperial unit-of-measure differs from its U.S. counterpart. The U.S. fluid ounce is larger than the British Imperial fluid ounce. However, the U.S. pint, quart, and gallon are smaller than the British Imperial pint, quart, and gallon, respectively. Should you need to convert from U.S. units to British Imperial units (or vice versa), refer to the following:

- fluid ounces (U.S.) x 1.042 = fluid ounces (Imp.)
- pints (U.S.) x 0.833 = pints (Imp.)
- quarts (U.S.) x 0.833 = quarts (Imp.)
- gallons (U.S.) x 0.833 = gallons (Imp.)
- fluid ounces (Imp.) x 0.960 = fluid ounces (U.S.)
- pints (Imp.) x 1.201 = pints (U.S.)
- quarts (Imp.) x 1.201 = quarts (U.S.)
- gallons (Imp.) x 1.201 = gallons (U.S.)

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TORQUE CONVERSIONS D.3

UNITED STATES SYSTEM

The U.S. units of torque, foot pounds and inch pounds, are used in this service manual. To convert units, use the following equations:

- foot pounds (ft-lbs) X 12.00000 = inch pounds (**in-lbs**).
- inch pounds (**in-lbs**) X 0.08333 = foot pounds (ft-lbs).

METRIC SYSTEM

All metric torque specifications are written in Newton-meters (Nm). To convert metric to United States units and United States to metric, use the following equations:

- Newton meters (Nm) X 0.737563 = foot pounds (ft-lbs).
- Newton meters (Nm) X 8.85085 = inch pounds (**in-lbs).**
- foot pounds (ft-lbs) X 1.35582 = Newton meters (Nm).
- inch pounds (**in-lbs**) X 0.112985 = Newton meters (Nm).

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GLOSSARY E.1

ACRONYMS AND ABBREVIATIONS

Table E-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
A	Amperes
AC	Alternating Current
ACC	Accessory
ACR	Automatic Compression Release
AGM	Absorbed Glass Mat (battery)
Amp	Ampere
AWG	American Wire Gauge
B+	Battery Voltage
BAS	Bank Angle Sensor
BTDC	Before Top Dead Center
C	Celsius (Centigrade)
CA	California
CAL	Calibration
CC	Cubic Centimeters
CCA	Cold Cranking Amps
CKP	Crankshaft Position
cm	Centimeter
DC	Direct Current
DLC	Data Link Connector
DOM	Domestic
DTC	Diagnostic Trouble Code
DVOM	Digital Volt Ohm Meter
ECM	Electronic Control Module
ECT	Engine Coolant Temperature
EEPROM	Electrically Erasable Programmable Read Only Memory
EFI	Electronic Fuel Injection
ET	Engine Temperature
EVAP	Evaporative Emissions Control System
F	Fahrenheit
ft-lbs	Foot-Pounds
fl oz.	Fluid Ounce
g	Gram
GAL	Gallon
GAWR	Gross Axle Weight Rating
GND	Ground (electrical)
GVWR	Gross Vehicle Weight Rating
HDI	Harley-Davidson International
H-DSSS	Harley-Davidson Smart Security System
HFSM	Hands Free Security Module
Hg	Mercury

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Table E-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
IAC	Idle Air Control
IAT	Intake Air Temperature
IC	Instrument Cluster
ID	Inside Diameter
IGN	Ignition Light/Key Switch
In.	Inch
INJ PW	Injector Pulse Width
in-lbs	Inch-Pounds
Kg	Kilogram
Km	Kilometer
kPa	Kilopascal
km/hr	Kilometers Per Hour
L	Liter
LCD	Liquid Crystal Display
LED	Light Emitting Diode
mA	Milliampere
MAP	Manifold Absolute Pressure
ml	milliliter
mm	millimeter
MPH	Miles Per Hour
ms	millisecond
Nm	Newton-Meter
N/A	Not Applicable
no.	Number
O2	Oxygen
OD	Outside Diameter
OEM	Original Equipment Manufacturer
oz	Ounce
P&A	Parts and Accessories
PN	Part Number
PSI	Pounds per Square Inch
PWM signal	Pulse Width Modulated signal
RES	Reserve
RPM	Revolutions Per Minute
SCFH	Cubic Feet per Hour at Standard Conditions
TCA	Throttle Control Actuator
TDC	Top Dead Center
TGS	Twist Grip Sensor
TP	Throttle Position
TMAP	Intake Air Temperature/Manifold Absolute Pressure
TSM	Turn Signal Module
TSSM	Turn Signal/Security Module
V	Volt

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Table E-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
VAC	Volts of Alternating Current
VDC	Volts of Direct Current
VIN	Vehicle Identification Number
VSS	Vehicle Speed Sensor

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Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
98716-87A	STORAGE COVER	1.25 STORAGE, Placing in Storage
99650-02	HIGH-PERFORMANCE SEALANT, GRAY	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
99863-01A	GLOBAL BATTERY CHARGER	1.17 BATTERY MAINTENANCE, Storage
B-45523	VALVE GUIDE REAMER	3.23 CYLINDER HEAD, Valve Guide Replacement
B-45524-1	VALVE GUIDE DRIVER	3.23 CYLINDER HEAD, Valve Guide Replacement
B-45524-2A	VALVE GUIDE INSTALLER SLEEVE	3.23 CYLINDER HEAD, Valve Guide Replacement
B-45525	VALVE GUIDE HONE	3.23 CYLINDER HEAD, Inspection
B-45525	VALVE GUIDE HONE	3.23 CYLINDER HEAD, Valve Guide Replacement
B-45655	CRANKCASE BEARING REMOVER/INSTALLER	3.28 CRANKCASE, Right Crankcase Half
B-45655	CRANKCASE BEARING REMOVER/INSTALLER	3.28 CRANKCASE, Right Crankcase Half
B-45655	CRANKCASE BEARING REMOVER/INSTALLER	3.28 CRANKCASE, Left Crankcase Half
B-45655	CRANKCASE BEARING REMOVER/INSTALLER	3.28 CRANKCASE, Left Crankcase Half
GA500A	SNAP-ON TERMINAL PICK	A.2 AUTOFUSE ELECTRICAL CONNECTORS, Autofuse Connector Repair
HD-25070	ROBINAIR HEAT GUN	2.46 WINDSHIELD: FLHR/C, Windshield Window
HD-25070	ROBINAIR HEAT GUN	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-25070	ROBINAIR HEAT GUN	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-25070	ROBINAIR HEAT GUN	A.17 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-33223-1	CYLINDER COMPRESSION GAUGE	3.8 TROUBLESHOOTING, Compression Test
HD-33416	UNIVERSAL DRIVER	2.21 STEERING HEAD BEARINGS, Removal
HD-34633	AIR SUSPENSION PUMP AND GAUGE	2.23 REAR SHOCK ABSORBERS, Removal
HD-34633A	AIR SUSPENSION PUMP AND GAUGE	1.18 SUSPENSION ADJUSTMENTS, General
HD-34633A	AIR SUSPENSION PUMP AND GAUGE	2.22 REAR AIR SUSPENSION, Check for Air Leaks
HD-34634	FORK OIL SEAL INSTALLER	2.19 FRONT FORK, Assembly
HD-34736-B	VALVE SPRING COMPRESSOR	3.23 CYLINDER HEAD, Disassembly
HD-34736-B	VALVE SPRING COMPRESSOR	3.23 CYLINDER HEAD, Assembly
HD-34751	VALVE GUIDE CLEANING BRUSH	3.23 CYLINDER HEAD, Inspection
HD-34751	VALVE GUIDE CLEANING BRUSH	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-34751	VALVE GUIDE CLEANING BRUSH	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-34751	VALVE GUIDE CLEANING BRUSH	3.23 CYLINDER HEAD, Valve and Seat Refacing
HD-34751	VALVE GUIDE CLEANING BRUSH	3.23 CYLINDER HEAD, Assembly
HD-34902-B	MAINSHAFT BEARING INNER RACE PULLER/INSTALLER	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-34902-C	MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER	5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race
HD-35316-10	PILOT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-11	RECEIVER CUP	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-12	INSTALLER CUP	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-3A	CROSS PLATE	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-3A	CROSS PLATE	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-4A	8 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-4A	8 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Installation

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-35316-5	12 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-5	12 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-7	WASHER	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-7	WASHER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-8	BEARING DRIVER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-9	BEARING DRIVER	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-C	MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35381A	BELT TENSION GAUGE	1.13 REAR BELT DEFLECTION, Checking Belt Deflection
HD-35381A	BELT TENSION GAUGE	1.13 REAR BELT DEFLECTION, Setting Belt Deflection
HD-35381A	BELT TENSION GAUGE	2.5 REAR WHEEL, Installation
HD-35667-A	CYLINDER LEAKDOWN TESTER	3.8 TROUBLESHOOTING, Cylinder Leakdown Test
HD-35758-C	NEWAY VALVE SEAT CUTTER SET	3.23 CYLINDER HEAD, Valve and Seat Refacing
HD-38125-6	PACKARD TERMINAL CRIMP TOOL	A.14 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.8 DEUTSCH MINI TERMINAL REPAIR, Deutsch Mini Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.14 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.14 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.17 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-39301A	STEERING HEAD BEARING CUP REMOVER	2.21 STEERING HEAD BEARINGS, Removal
HD-39302	STEERING HEAD BEARING CUP INSTALLER	2.21 STEERING HEAD BEARINGS, Installation
HD-39361-B	SPROCKET SHAFT OIL SEAL INSTALLER	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
HD-39782-1	CYLINDER HEAD SUPPORT STAND	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39782-3	INTAKE SEAT ADAPTER	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39782-4	EXHAUST SEAT ADAPTER	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39782-B	CYLINDER HEAD SUPPORT STAND KIT	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.23 CYLINDER HEAD, Disassembly
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.23 CYLINDER HEAD, Valve and Seat Refacing
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.23 CYLINDER HEAD, Assembly
HD-39787A	RIVET TOOL	2.32 TOUR-PAK SERVICE, Hinges
HD-39847	REAMER T-HANDLE	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39964	REAMER LUBRICANT	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL	A.6 DEUTSCH STANDARD TERMINAL REPAIR, Deutsch Standard Terminal Crimps
HD-39969	ULTRA TORCH UT-100	A.17 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair

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Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41177	FORK TUBE HOLDER	2.19 FRONT FORK, Changing Fork Oil
HD-41177	FORK TUBE HOLDER	2.19 FRONT FORK, Assembly
HD-41182	FUEL PRESSURE GAUGE	4.18 FUEL PRESSURE TEST, Testing
HD-41183	HEAT SHIELD ATTACHMENT	A.17 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41417	PROPANE ENRICHMENT KIT	4.21 INTAKE LEAK TEST, Leak Tester
HD-41475	DEUTSCH CONNECTOR SERVICE KIT	A.5 DEUTSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41475-100	FLAT BLADE L-HOOK	A.5 DEUTSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41609	AMP MULTILOCK CRIMPER	A.1 AMP MULTILOCK CONNECTORS, AMP Multilock Connector Repair
HD-42135	T-30 I.P. (TORX PLUS) DRIVER	2.8 WHEEL LACING: 16 INCH FRONT RIM, General
HD-42310	BENCH STAND	3.14 REMOVING ENGINE FROM CHASSIS, Procedure
HD-42310	BENCH STAND	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
HD-42310-2	TWIN CAM 88 CRADLE	3.14 REMOVING ENGINE FROM CHASSIS, Procedure
HD-42311	OIL FILTER WRENCH	1.6 ENGINE OIL AND FILTER, Changing Oil and Oil Filter
HD-42311	OIL FILTER WRENCH	1.6 ENGINE OIL AND FILTER, Changing Oil and Oil Filter
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER	3.16 TOP END OVERHAUL: DISASSEMBLY, Piston
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER	3.17 TOP END OVERHAUL: ASSEMBLY, Piston
HD-42320-B	PISTON PIN REMOVER	3.16 TOP END OVERHAUL: DISASSEMBLY, Piston
HD-42322	PISTON SUPPORT PLATE	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-42324-A	CYLINDER TORQUE PLATES	3.16 TOP END OVERHAUL: DISASSEMBLY, Cylinder Head
HD-42324-A	CYLINDER TORQUE PLATES	3.23 CYLINDER HEAD, Inspection
HD-42324-A	CYLINDER TORQUE PLATES	3.24 CYLINDER, Cleaning
HD-42325-A	CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER	3.26 CAM SUPPORT PLATE AND COVER, Cam Needle Bearings
HD-42326-B	CRANKSHAFT GUIDE	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE	3.28 CRANKCASE, Right Crankcase Half
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE	3.28 CRANKCASE, Right Crankcase Half
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE	3.28 CRANKCASE, Left Crankcase Half
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE	3.28 CRANKCASE, Left Crankcase Half
HD-42879	ELECTRICAL CRIMPER TOOL	A.7 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR, Deutsch Solid Barrel Terminal Crimps
HD-43646A	ROLLING STAND	3.14 REMOVING ENGINE FROM CHASSIS, Procedure
HD-43646A	ROLLING STAND	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
HD-44060B	WHEEL BEARING REMOVER/INSTALLER	2.11 SEALED WHEEL BEARINGS, Removal

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Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-44061	FUEL PRESSURE GAUGE ADAPTER	4.18 FUEL PRESSURE TEST, Testing
HD-44067A	OIL FILTER WRENCH	1.6 ENGINE OIL AND FILTER, Changing Oil and Oil Filter
HD-44358	FLYWHEEL SUPPORT FIXTURE	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-45327	REAR FORK BEARING INSTALLER	2.24 REAR FORK, Disassembly and Assembly
HD-45928	PACKARD MICRO-64 TERMINAL REMOVER	A.16 PACKARD MICRO-64 CONNECTORS, Packard Micro-64 Connector Repair
HD-45929	PACKARD MICRO-64 TERMINAL CRIMPER	A.16 PACKARD MICRO-64 CONNECTORS, Packard Micro-64 Connector Repair
HD-45961	IGNITION SWITCH CONNECTOR REMOVER	2.44 INNER FAIRING: FLTR, Removal
HD-45961	IGNITION SWITCH CONNECTOR REMOVER	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR
HD-45962	IGNITION SWITCH ALIGNMENT TOOL	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR
HD-46282A	FINAL DRIVE SPROCKET LOCKING TOOL	5.7 TRANSMISSION SPROCKET, Removal
HD-46282A	FINAL DRIVE SPROCKET LOCKING TOOL	5.7 TRANSMISSION SPROCKET, Installation
HD-47248	LOWER ROCKER BOX WRENCH	3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Covers
HD-47250	INTAKE MANIFOLD WRENCH	4.13 INDUCTION MODULE, Removal
HD-47258	UPPER ROCKER BOX WRENCH	3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Covers
HD-47856-1	INSTALLER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-2	PILOT	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-3	ADAPTER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-6	NUT	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-7	CROW'S FOOT WRENCH	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47910	MAINSHAFT LOCKNUT WRENCH	5.7 TRANSMISSION SPROCKET, Removal
HD-47910	MAINSHAFT LOCKNUT WRENCH	5.7 TRANSMISSION SPROCKET, Installation
HD-47925	AXLE NUT TORQUE ADAPTER	1.13 REAR BELT DEFLECTION, Setting Belt Deflection
HD-47925	AXLE NUT TORQUE ADAPTER	1.13 REAR BELT DEFLECTION, Setting Belt Deflection
HD-47925	AXLE NUT TORQUE ADAPTER	2.5 REAR WHEEL, Removal
HD-47932	MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL	6.7 MAIN DRIVE GEAR AND BEARING, Cleaning and Inspection
HD-47933	MAIN DRIVE GEAR SEAL INSTALLER	6.7 MAIN DRIVE GEAR AND BEARING, Mainshaft Seal Replacement
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL	3.18 BOTTOM END OVERHAUL: DISASSEMBLY, Cam Support Plate and Cover
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
HD-47956	CAMSHAFT ASSEMBLY TOOL	3.26 CAM SUPPORT PLATE AND COVER, Camshafts
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER	A.9 MOLEX CONNECTORS, Molex Connector Repair
HD-48119	ELECTRICAL CRIMP TOOL	A.9 MOLEX CONNECTORS, Crimp Terminal to Lead
HD-48219	PRIMARY DRIVE LOCKING TOOL	5.4 DRIVE COMPONENTS, Removal
HD-48262	O2 SENSOR SOCKET	4.15 OXYGEN SENSORS (O2), Removal

DIGITAL TECHNICIAN HARLEY-DAVIDSON

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-48283	CRANKSHAFT ROTATING WRENCH	3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate
HD-48646	CAM RING REMOVER/INSTALLER	4.6 FUEL TANK TOP PLATE, Removal
HD-48650	DIGITAL TECHNICIAN II	1.16 BLEEDING BRAKES, Procedure
HD-48650	DIGITAL TECHNICIAN II	C.1 ABS MODULE, Installation
HD-48650	DIGITAL TECHNICIAN II	C.1 ABS MODULE, Installation
HD-48921	REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER	2.6 REAR WHEEL COMPENSATOR, Sprocket Bearing Replacement
HD-59000B	FORK OIL LEVEL GAUGE	2.19 FRONT FORK, Changing Fork Oil
HD-94660-2	PILOT	5.7 TRANSMISSION SPROCKET, Removal
HD-94660-2	PILOT	5.7 TRANSMISSION SPROCKET, Installation
HD-94681-80	SPOKE WRENCH	2.12 TRUING LACED WHEELS, Lateral Truing
HD-94804-57	ROCKER ARM BUSHING REAMER	3.21 ROCKER ARM SUPPORT PLATE, Cleaning and Inspection
HD-95637-10	LONG BOLTS	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-95637-46B	WEDGE ATTACHMENT	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-95637-46B	WEDGE ATTACHMENT	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-95637-46B	WEDGE ATTACHMENT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-95952-1	THREADED CYLINDERS	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-95952-33C	CONNECTING ROD CLAMPING TOOL	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-96333-51F	PISTON RING COMPRESSOR	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-96796-47	VALVE SPRING TESTER	3.23 CYLINDER HEAD, Inspection
HD-96921-52D	OIL PRESSURE GAUGE SET	3.7 OIL PRESSURE, Checking Oil Pressure
HD-97225-55C	SPROCKET SHAFT BEARING INSTALLER	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
HD-97225-55C	SPROCKET SHAFT BEARING INSTALLER	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-99500-80	WHEEL TRUING STAND	2.7 CHECKING RIM RUNOUT, Inspection
HD-99500-80	WHEEL TRUING STAND	2.12 TRUING LACED WHEELS, Lateral Truing
HD-99500-80	WHEEL TRUING AND BALANCING STAND	2.13 CHECKING CAST WHEEL RUNOUT, Radial Runout
J-5586A	TRANSMISSION SHAFT RETAINING RING PLIERS	6.6 TRANSMISSION ASSEMBLY, Disassembly
RS-25100-200	NICE BEARING	6.7 MAIN DRIVE GEAR AND BEARING, Removal
RS-25100-200	NICE BEARING	6.7 MAIN DRIVE GEAR AND BEARING, Removal
SNAP-ON BB200A	BASIC VACUUM BRAKE BLEEDER	1.16 BLEEDING BRAKES, Procedure
SNAP-ON BB200A	BASIC VACUUM BRAKE BLEEDER	C.1 ABS MODULE, Removal
SNAP-ON BB200A	BASIC VACUUM BRAKE BLEEDER	C.1 ABS MODULE, Installation
SNAP-ON FC018	OPEN END CROWFOOT	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
SNAP-ON TT600-3	SNAP-ON PICK	A.13 PACKARD 630 METRI-PACK CONNECTORS, 630 Metri-Pack Connector Repair
TA360	SNAP-ON TORQUE ANGLE GAUGE	3.24 CYLINDER, Inspection

NOTES

FASTENER	TORQUE VALUE		NOTES
2 inch diameter gauge nuts	10-20 **in-lbs**	1.1-2.3 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
2 inch diameter gauge nuts	10-20 **in-lbs**	1.1-2.3 Nm	7.29 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR, 2 Inch Diameter Gauges: Fuel Level, Ambient Air Temperature, Voltmeter, Oil Pressure
ABS ECU-to-HCU fastener	35-45 **in-lbs**	4.0-5.1 Nm	C.1 ABS MODULE, Installation
ABS module fastener	39-60 **in-lbs**	4.4-6.8 Nm	C.1 ABS MODULE, Installation
Adjuster screw jam nut	72-120 **in-lbs**	8.1-13.6 Nm	1.11 CLUTCH, Adjustment
Air baffle hex screws (FLTR)	120-144 **in-lbs**	13.6-16.3 Nm	2.20 AIR BAFFLE: FLTR, Air Baffle (FLTR)
Air baffle hex screws (FLTR)	120-144 **in-lbs**	13.6-16.3 Nm	2.20 AIR BAFFLE: FLTR, Air Baffle (FLTR)
Air baffle screws (FLTR)	120-144 **in-lbs**	13.6-16.3 Nm	2.21 STEERING HEAD BEARINGS, Installation
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	1.3 MAINTENANCE SCHEDULE, General
Air cleaner cover bracket screws	40-60 **in-lbs**	4.5-6.8 Nm	1.9 AIR CLEANER AND EXHAUST SYSTEM, Installation/metric
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.3 MAINTENANCE SCHEDULE, General
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.9 AIR CLEANER AND EXHAUST SYSTEM, Installation/Use Loctite Medium Strength Threadlocker 243 (Blue)
Air deflector bolts	25-35 **in-lbs**	2.8-4.0 Nm	2.40 AIR DEFLECTORS, Mid-Frame Air Deflectors
Air deflector screws	25-30 **in-lbs**	2.8-3.4 Nm	2.40 AIR DEFLECTORS, Air Deflectors (FLHTCU)
Air valve mount hex nut	40-50 **in-lbs**	4.5-5.6 Nm	2.22 REAR AIR SUSPENSION, Check for Air Leaks
Auxiliary lamp bracket to fork bracket screws	15-20 ft-lbs	20-27 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
Auxiliary lamp bracket to fork bracket screws (FLHT/C/U)	15-20 ft-lbs	20-27 Nm	7.13 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Bracket
Auxiliary lamp bracket to fork bracket stud acorn nuts (FLHR/C)	72-108 **in-lbs**	8.1-12.2 Nm	7.13 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Bracket
Auxiliary lamp flange nut	15-18 ft-lbs	20.3-24.4 Nm	1.23 HEADLAMP ALIGNMENT, Auxiliary Lamp Alignment
Banjo bleeder bolts to calipers	17-19 ft-lbs	23.1-25.8 Nm	C.3 ABS BRAKE LINES, ABS Module to Front Brake Calipers
Banjo bleeder bolt to caliper	17-19 ft-lbs	23.1-25.8 Nm	2.15 FRONT BRAKE CALIPER, Installation
Banjo bleeder bolt to front brake caliper	17-19 ft-lbs	23.1-25.8 Nm	2.14 FRONT BRAKE MASTER CYLINDER, Front Brake Line - Non-ABS Equipped
Banjo bolt to ABS module	12.5-14.5 ft-lbs	16.9-19.7 Nm	C.1 ABS MODULE, Installation
Banjo bolt to ABS module	12.5-14.5 ft-lbs	16.9-19.7 Nm	C.3 ABS BRAKE LINES, Front Master Cylinder to ABS Module
Banjo bolt to ABS module	12.5-14.5 ft-lbs	16.9-19.7 Nm	C.3 ABS BRAKE LINES, ABS Module to Front Brake Calipers
Banjo bolt to ABS module	12.5-14.5 ft-lbs	16.9-19.7 Nm	C.3 ABS BRAKE LINES, Rear Master Cylinder to ABS Module
Banjo bolt to ABS module	12.5-14.5 ft-lbs	16.9-19.7 Nm	C.3 ABS BRAKE LINES, ABS Module to Rear Brake Caliper
Banjo bolt to caliper	17-19 ft-lbs	23.1-25.8 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped
Banjo bolt to caliper	17-19 ft-lbs	23.1-25.8 Nm	2.17 REAR BRAKE CALIPER, Installation
Banjo bolt to front master cylinder	12.5-14.5 ft-lbs	16.9-19.7 Nm	C.3 ABS BRAKE LINES, Front Master Cylinder to ABS Module

FASTENER	TORQUE VALUE		NOTES
Banjo bolt to master cylinder	13-15 ft-lbs	17.6-20.3 Nm	2.14 FRONT BRAKE MASTER CYL-INDER, Assembly and Installation
Banjo bolt to master cylinder	13-15 ft-lbs	17.6-20.3 Nm	2.16 REAR BRAKE MASTER CYL-INDER, Assembly and Installation
Banjo bolt to master cylinder	12.5-14.5 ft-lbs	16.9-19.7 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped
Banjo bolt to master cylinder	12.5-14.5 ft-lbs	17.0-19.7 Nm	C.3 ABS BRAKE LINES, Rear Master Cylinder to ABS Module
Banjo bolt to master cylinder reservoir	12.5-14.5 ft-lbs	17.0-19.7 Nm	2.14 FRONT BRAKE MASTER CYLINDER, Front Brake Line - Non-ABS Equipped
Banjo bolt to rear caliper	17-19 ft-lbs	23.1-25.8 Nm	C.3 ABS BRAKE LINES, ABS Module to Rear Brake Caliper
Battery terminal bolt	60-70 **in-lbs**	6.8-7.9 Nm	1.3 MAINTENANCE SCHEDULE, General
Battery terminal bolt	60-70 **in-lbs**	6.8-7.9 Nm	1.17 BATTERY MAINTENANCE, Battery
Battery terminal bolt	60-70 **in-lbs**	6.8-7.9 Nm	1.17 BATTERY MAINTENANCE, Battery
Battery terminal bolt	60-70 **in-lbs**	6.8-7.9 Nm	7.9 STARTER, Installation
Battery terminal bolt	60-70 **in-lbs**	6.8-7.9 Nm	7.22 ALTERNATOR, Installation
Battery tray screws	72-96 **in-lbs**	8.1-10.8 Nm	2.51 REAR FRAME, Rear Frame
Battery tray screws	72-96 **in-lbs**	8.1-10.9 Nm	7.7 ELECTRICAL CADDIES, Battery Tray
Brake caliper (front) mounting screws	28-38 ft-lbs	37.9-51.5 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement/metric
Brake caliper (front) mounting screws	28-38 ft-lbs	37.9-51.5 Nm	2.15 FRONT BRAKE CALIPER, Installation/metric
Brake caliper (rear) socket head screws	43-48 ft-lbs	58.3-65.1 Nm	2.5 REAR WHEEL, Installation/metric
Brake caliper (rear) to caliper bracket screws	43-48 ft-lbs	58.3-65.1 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement/metric
Brake caliper (rear) to caliper bracket screws	43-48 ft-lbs	58.3-65.1 Nm	2.17 REAR BRAKE CALIPER, Installation/metric
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	1.16 BLEEDING BRAKES, Procedure
Brake caliper pad pin	75-102 **in-lbs**	8.5.-11.5 Nm	1.3 MAINTENANCE SCHEDULE, General
Brake caliper pad pin	75-102 **in-lbs**	8.5-11.5 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement/Always use new pin
Brake caliper pad pin	75-102 **in-lbs**	8.5-11.5 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement/Always use new pin
Brake disc (front) screws	16-24 ft-lbs	22-33 Nm	2.4 FRONT WHEEL, Installation/Always use new screws
Brake disc (rear) screws	30-45 ft-lbs	41-61 Nm	2.5 REAR WHEEL, Installation/Always use new screws
Brake light switch bracket fastener	80-100 **in-lbs**	9.0-11.3 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped
Brake light switch bracket fastener	80-100 **in-lbs**	9.0-11.3 Nm	C.3 ABS BRAKE LINES, Rear Master Cylinder to ABS Module
Brake line bracket flange screw	20-30 **in-lbs**	2.3-3.4 Nm	C.3 ABS BRAKE LINES, Front Master Cylinder to ABS Module
Brake line bracket flange screw	20-30 **in-lbs**	2.3-3.4 Nm	C.3 ABS BRAKE LINES, ABS Module to Front Brake Calipers
Brake line bracket to lower fork bracket screw	120-180 **in-lbs**	13.6-20.3 Nm	2.21 STEERING HEAD BEARINGS, Installation

FASTENER	TORQUE VALUE		NOTES
Brake pedal shaft locknut	15-20 ft-lbs	20-27 Nm	2.16 REAR BRAKE MASTER CYL-INDER, Assembly and Installation
Brake pedal shaft locknut	15-20 ft-lbs	20-27 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped
Brake pedal shaft locknut	15-20 ft-lbs	20-27 Nm	C.3 ABS BRAKE LINES, Rear Master Cylinder to ABS Module
Breather assembly bolts	90-120 **in-lbs**	10.2-13.6 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly
Breather bolts	22-24 ft-lbs	29.8-32.5 Nm	4.4 AIR CLEANER ASSEMBLY, Installation/metric
Cam chain tensioner fasteners	100-120 **in-lbs**	11.3-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam cover screws	125-155 **in-lbs**	14.1-17.5 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
CB module to radio screw	35-45 **in-lbs**	4.0-5.1 Nm	7.33 ADVANCED AUDIO SYSTEM, Radio (Storage Box)
CB module to radio screw	35-45 **in-lbs**	4.0-5.1 Nm	7.33 ADVANCED AUDIO SYSTEM, CB Module
Chain tensioner fasteners	15-19 ft-lbs	20.3-25.8 Nm	5.4 DRIVE COMPONENTS, Installation
Charcoal canister screws	10-15 **in-lbs**	1.1-1.7 Nm	4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister/metric
CKP sensor mount screw	90-120 **in-lbs**	10.2-13.6 Nm	7.21 CRANKSHAFT POSITION SENSOR (CKP), Installation
Clutch adjuster screw locknut	72-120 **in-lbs**	8.1-13.6 Nm	1.3 MAINTENANCE SCHEDULE, General
Clutch cable fitting	90-120 **in-lbs**	10.2-13.6 Nm	2.25 CLUTCH CABLE, Installation
Clutch cable fitting	90-120 **in-lbs**	10.2-13.6 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Clutch diaphragm spring retainer bolts	90-110 **in-lbs**	10.2-12.4 Nm	5.6 CLUTCH, Clutch Pack Only
Clutch hub mainshaft nut	70-80 ft-lbs	94.9-108.5 Nm	5.4 DRIVE COMPONENTS, Installation
Clutch inspection cover screws	84-108 **in-lbs**	9.5-12.2 Nm	1.3 MAINTENANCE SCHEDULE, General
Clutch inspection cover screws	84-108 **in-lbs**	9.5-12.2 Nm	1.7 PRIMARY CHAIN, Chaincase Lubricant
Clutch inspection cover screws	84-108 **in-lbs**	9.5-12.2 Nm	1.11 CLUTCH, Adjustment
Clutch lever bracket handlebar clamp screws	72-108 **in-lbs**	8-12 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
Clutch release cover screws	84-108 **in-lbs**	9.5-12.2 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Compensating sprocket bolt	100 ft-lbs	135.7 Nm	5.4 DRIVE COMPONENTS, Installation/Initial torque then back off one turn.
Compensating sprocket bolt	140 ft-lbs	190.0 Nm	5.4 DRIVE COMPONENTS, Installation/Final torque
Console rear bracket screws	20-30 **in-lbs**	2.7-3.4 Nm	4.5 FUEL TANK, Installation
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	4.5 FUEL TANK, Installation
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	4.5 FUEL TANK, Evaporative Emissions Tube: Non-CA Models/metric
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	4.6 FUEL TANK TOP PLATE, Installation/metric

FASTENER	TORQUE VALUE		NOTES
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Fuel Vapor Vent Tube/metric
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	7.31 GAUGES AND INSTRUMENTS: FLHR/C, Speedometer
Console-to-tank screw	36-60 **in-lbs**	4.1-6.8 Nm	7.32 INDICATOR LAMPS: FLHR/C, Indicator Lamps
Cover bracket screws	40-60 **in-lbs**	4.5-6.8 Nm	4.4 AIR CLEANER ASSEMBLY, Installation/metric
Cover screw	36-60 **in-lbs**	4.1-6.8 Nm	4.4 AIR CLEANER ASSEMBLY, Installation/Use Loctite Medium Strength Threadlocker 243 (Blue)
Crankcase bolts, final	15-19 ft-lbs	20.3-25.8 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Crankcase bolts, initial	10 ft-lbs	13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Crankcase pipe plugs	120-144 **in-lbs**	13.6-16.3 Nm	3.28 CRANKCASE, Pipe Plug and Oil Fittings
Crankcase to front engine mounting bracket nuts	36-40 ft-lbs	48.8-54.2 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Crank sprocket bolt, final torque	24 ft-lbs	32.5 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Crossover pipe hanger bracket	84-132 **in-lbs**	9.5-14.9 Nm	3.30 OIL PAN, Installation
Crossover pipe hanger bracket	84-132 **in-lbs**	9.5-14.9 Nm	4.19 EXHAUST SYSTEM, System Installation
Crossover support clamp-to-transmission bracket fastener	14-18 ft-lbs	19.0-24.4 Nm	4.19 EXHAUST SYSTEM, System Installation
Cylinder head bolts, final	15-17 ft-lbs	20.3-23.0 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head/See special method to tighten
Cylinder head bolts, final	15-17 ft-lbs	20.3-23.1 Nm	3.24 CYLINDER, Inspection
Cylinder head bolts, initial	120-144 **in-lbs**	13.5-16.2 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head/See special method to tighten
Cylinder head bolts, initial	120-144 **in-lbs**	13.6-16.3 Nm	3.24 CYLINDER, Inspection
Cylinder head flange adapter screws	96-144 **in-lbs**	10.9-16.3 Nm	4.13 INDUCTION MODULE, Installation/metric
Cylinder head flange adapter screws	96-144 **in-lbs**	10.9-16.3 Nm	4.13 INDUCTION MODULE, Installation/metric
Cylinder stud	10-20 ft-lbs	3.6-27.1 Nm	3.28 CRANKCASE, Cylinder Studs
Diaphragm spring retainer bolts	90-110 **in-lbs**	10.2-12.4 Nm	5.6 CLUTCH, Clutch Pack and Bearing
Electrical caddy (left) screws	72-96 **in-lbs**	8.1-10.9 Nm	4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister/metric
Engine guard T40 TORX screws	15-20 ft-lbs	20.3-27.1 Nm	2.36 LOWER FAIRING AND ENGINE GUARD, Engine Guard
Engine mount bracket fasteners	36-40 ft-lbs	48.8-54.2 Nm	2.54 FRONT ENGINE MOUNT, Installation
Engine mount end cap fasteners	42-48 ft-lbs	56.9-65.0 Nm	2.54 FRONT ENGINE MOUNT, Installation
Engine oil drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.3 MAINTENANCE SCHEDULE, General
Engine oil drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.6 ENGINE OIL AND FILTER, Changing Oil and Oil Filter
Engine oil drain plug	14-21 ft-lbs	19.0-28.5 Nm	3.30 OIL PAN, Installation/Clean plug before installation
Engine to front engine mounting bracket	36-40 ft-lbs	49-54 Nm	1.24 ENGINE MOUNTS, Inspection
ET sensor	120-180 **in-lbs**	13.6-20.3 Nm	4.12 ENGINE TEMPERATURE SENSOR (ET), Installation

FASTENER	TORQUE VALUE		NOTES
Exhaust crossover pipe clamp	25-30 ft-lbs	33.9-40.7 Nm	4.19 EXHAUST SYSTEM, System Installation/Always use a new clamp
Exhaust flange adapter nuts	100-120 **in-lbs**	11.3-13.6 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust flange adapter nuts	100-120 **in-lbs**	11.3-13.6 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust flange adapter nuts	100-120 **in-lbs**	11.3-13.6 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust flange adapter nuts	100-120 **in-lbs**	11.3-13.6 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust heat shield worm drive clamp screw	20-40 **in-lbs**	2.3-4.5 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust side bracket carriage bolt	20-25 ft-lbs	27.1-33.9 Nm	4.19 EXHAUST SYSTEM, System Installation
Exhaust valve actuator fasteners	32-40 **in-lbs**	3.6-4.5 Nm	4.20 ACTIVE EXHAUST (HDI), Exhaust Valve Actuator
Fairing bracket/steering head thru bolt locknuts (FLTR)	20-30 ft-lbs	27.1-40.7 Nm	2.44 INNER FAIRING: FLTR, Installation
Fairing cap screws	25-30 **in-lbs**	2.8-3.4 Nm	2.38 FAIRING CAP: FLHX, FLHT/C/U, Fairing Cap
Fairing cap screws	25-30 **in-lbs**	2.8-3.4 Nm	7.19 FAIRING CAP SWITCHES: FLHTC/U, Installation
Fairing speaker lower screw (FLHX, FLHTC/U)	22-28 **in-lbs**	2.5-3.2 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
Fairing speaker lower screw (FLHX, FLHTC/U)	22-28 **in-lbs**	2.5-3.2 Nm	7.33 ADVANCED AUDIO SYSTEM, Front Fairing Speakers
Fairing speaker upper screws (FLHX, FLHTC/U)	35-50 **in-lbs**	4.0-5.7 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
Fairing speaker upper screws (FLHX, FLHTC/U)	35-50 **in-lbs**	4.0-5.7 Nm	7.33 ADVANCED AUDIO SYSTEM, Front Fairing Speakers
Fork bracket pinch bolt	53-57 ft-lbs	71.9-77.3 Nm	1.21 STEERING HEAD BEARINGS, Adjustment
Fork bracket pinch bolt	53-57 ft-lbs	71.9-77.3 Nm	2.19 FRONT FORK, Installation
Fork cap bolt	60-70 ft-lbs	81.4-94.9 Nm	2.19 FRONT FORK, Installation
Fork damper tube screw (6mm)	132-216 **in-lbs**	14.9-24.4 Nm	2.19 FRONT FORK, Assembly
Fork lock screws (FLHR/C)	36-60 **in-lbs**	4.1-6.8 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHR/C
Fork oil drain plug	72-96 **in-lbs**	8-11 Nm	2.19 FRONT FORK, Changing Fork Oil
Fork stem nut	70-80 ft-lbs	94.9-108.4 Nm	1.21 STEERING HEAD BEARINGS, Adjustment/Anti-seize
Fork stem nut	70-80 ft-lbs	94.9-108.4 Nm	1.21 STEERING HEAD BEARINGS, Adjustment/Anti-seize
Fork stem nut	70-80 ft-lbs	95-109 Nm	2.21 STEERING HEAD BEARINGS, Installation
Fork tube plug	60-70 ft-lbs	81.4-94.9 Nm	2.19 FRONT FORK, Changing Fork Oil
Frame cover fastener, rear	15-20 ft lbs	20.3-27.1 Nm	2.31 TOUR-PAK, Luggage Rack/Tour-Pak Support
Frame cover fastener, rear	15-20 ft-lbs	20-27 Nm	2.49 REAR FENDER, Installation
Front axle holder nuts	132-180 **in-lbs**	14.9-20.3 Nm	2.4 FRONT WHEEL, Installation/metric
Front axle nut	60-65 ft-lbs	81.4-88.1 Nm	2.4 FRONT WHEEL, Installation/metric
Front brake caliper mounting screws	28-38 ft-lbs	37.9-51.5 Nm	C.2 WHEEL SPEED SENSORS, Front Wheel Speed Sensor
Front brake line bracket screw	120-180 **in-lbs**	13.6-20.3 Nm	2.14 FRONT BRAKE MASTER CYLINDER, Front Brake Line - Non-ABS Equipped

FASTENER	TORQUE VALUE		NOTES
Front brake line-to-lower fork bracket fastener	120-180 **in-lbs**	13.6-20.3 Nm	C.3 ABS BRAKE LINES, ABS Module to Front Brake Calipers
Front cylinder head exhaust flange nut	9-18 **in-lbs**	1-2 Nm	4.19 EXHAUST SYSTEM, System Installation
Front engine mount end cap fastener	42-48 ft-lbs	56.9-65.0 Nm	1.24 ENGINE MOUNTS, Inspection
Front engine mount fasteners	40-50 ft-lbs	54.2-67.8 Nm	2.54 FRONT ENGINE MOUNT, Installation
Front fender mount screws	16-20 ft-lbs	22-27 Nm	2.48 FRONT FENDER, Installation
Front fender tip lamp bracket screws	20-25 **in-lbs**	2.3-2.8 Nm	7.15 FENDER TIP LAMPS, Front Fender Tip Lamp
Front fender tip lamp bracket screws	20-25 **in-lbs**	2.3-2.8 Nm	7.15 FENDER TIP LAMPS, Front Fender Tip Lamp Jumper Harness
Front fender tip lamp trim strip tee bolt nuts	10-15 **in-lbs**	1.1-1.7 Nm	7.15 FENDER TIP LAMPS, Front Fender Tip Lamp Jumper Harness
Front master cylinder reservoir cover screws	7-10 **in-lbs**	0.8-1.1 Nm	1.14 BRAKES, Fluid Inspection
Front master cylinder reservoir cover screws	7-10 **in-lbs**	0.8-1.1 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement
Front master cylinder reservoir cover screws	7-10 **in-lbs**	0.8-1.1 Nm	1.16 BLEEDING BRAKES, Procedure
Front stabilizer link eyelet	18-22 ft-lbs	24.4-29.9 Nm	1.24 ENGINE MOUNTS, Inspection
Front stabilizer link eyelet	18-22 ft-lbs	24.4-29.9 Nm	1.24 ENGINE MOUNTS, Inspection
Front turn signal lamp bracket stud acorn nuts (FLTR)	40-50 **in-lbs**	4.5-5.7 Nm	2.41 UPPER FAIRING AND WINDSHIELD: FLTR, Outer Fairing
Front turn signal lamp mounting bracket screws (FLHR/C, FLHT/C/U)	30-60 **in-lbs**	4.1-6.8 Nm	7.16 TURN SIGNAL LAMPS, Front Turn Signal Lamp
Front turn signal lamp mounting bracket screws (FLHX)	15-20 ft-lbs	20-27 Nm	7.16 TURN SIGNAL LAMPS, Front Turn Signal Lamp
Fuel supply line quick-connect fitting	22-26 ft-lbs	29.8-35.3 Nm	4.5 FUEL TANK, Fuel Supply Check Valve/Tube/metric
Fuel supply tube clamp screw	66-82 **in-lbs**	7.5-9.3 Nm	4.16 FUEL INJECTORS, Installation/metric
Fuel tank console screws	36-60 **in-lbs**	4.1-6.8 Nm	7.33 ADVANCED AUDIO SYSTEM, Front Headset Receptacle
Fuel tank front screws	15-20 ft-lbs	20.3-27.1 Nm	4.5 FUEL TANK, Installation
Fuel tank rear bracket screws	15-20 ft-lbs	20.3-27.1 Nm	4.5 FUEL TANK, Installation
Guard to frame screws	32-36 ft-lbs	43.4-48.8 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Handlebar clamp screws	72-80 **in-lbs**	8-9 Nm	4.10 TWIST GRIP SENSOR, Installation/metric
Handlebar clamp to clutch lever bracket screws	72-108 **in-lbs**	8-12 Nm	2.26 HANDLEBARS, Adjustment
Handlebar clamp to clutch lever bracket screws	72-108 **in-lbs**	8.0-12.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Left Side Handlebar Switches
Handlebar clamp to clutch lever bracket screws	72-108 **in-lbs**	8.0-12.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Installation
Handlebar clamp to clutch lever bracket T27 TORX screws	60-80 **in-lbs**	6.8-9.0 Nm	2.25 CLUTCH CABLE, Installation
Handlebar clamp to master cylinder reservoir screws	72-80 **in-lbs**	8-9 Nm	2.26 HANDLEBARS, Adjustment
Handlebar clamp to master cylinder screws	72-80 **in-lbs**	8.0-9.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Right Side Handlebar Switches

FASTENER	TORQUE VALUE		NOTES
Handlebar clamp to master cylinder screws	72-80 **in-lbs**	8.0-9.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Installation
Handlebar lower clamp bolts (risers)	30-40 ft-lbs	40.7-54.2 Nm	2.26 HANDLEBARS, Rubber Mounts
Handlebar switch housing screw	35-45 **in-lbs**	4.0-5.1 Nm	1.3 MAINTENANCE SCHEDULE, General
Handlebar switch housing screws	35-45 **in-lbs**	4-5 Nm	4.10 TWIST GRIP SENSOR, Installation/metric
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Right Side Handlebar Switches
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Left Side Handlebar Switches
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Installation
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.0 Nm	7.40 HANDLEBAR SWITCH ASSEMBLIES, Installation
Handlebar upper clamp screws	16-20 ft-lbs	21.7-27.1 Nm	2.26 HANDLEBARS, Adjustment
Handlebar upper clamp screws	16-20 ft-lbs	21.7-27.1 Nm	2.26 HANDLEBARS, Installation
Handlebar upper clamp screws	16-20 ft-lbs	21.7-27.1 Nm	2.26 HANDLEBARS, Installation
Harness ground stud flange nuts	50-90 **in-lbs**	5.7-10.2 Nm	7.35 MAIN WIRING HARNESS, Installation: All Models (Part 1)/(10 mm)
Harness ground stud flange nuts	50-90 **in-lbs**	5.7-10.2 Nm	7.35 MAIN WIRING HARNESS, Installation: All Models (Part 1)/(10 mm)
Headlamp door screw	9-18 **in-lbs**	1.0-2.0 Nm	2.48 FRONT FENDER, Installation
Headlamp door screw	9-18 **in-lbs**	1.0-2.0 Nm	7.11 HEADLAMP: ALL EXCEPT FLTR, Headlamp Assembly
Headlamp housing Phillips screws	9-18 **in-lbs**	1.0-2.0 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation
Headlamp housing Phillips screws	9-18 **in-lbs**	1.0-2.0 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation
Headlamp housing screws (FLHR/C/S)	9-18 **in-lbs**	1.0-2.0 Nm	2.48 FRONT FENDER, Installation
Headlamp housing screws (FLHR/C)	9-18 **in-lbs**	1.0-2.0 Nm	7.11 HEADLAMP: ALL EXCEPT FLTR, Headlamp Assembly
Headlamp nacelle handlebar chrome strip flange nut	15-20 **in-lbs**	1.7-2.3 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation
Headlamp nacelle handlebar clamp shroud Phillips screws	10-20 **in-lbs**	1.1-2.3 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation
Headlamp nacelle handlebar clamp shroud Phillips screws	10-20 **in-lbs**	1.1-2.3 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation
Headlamp nacelle to fork bracket stud acorn nuts	72-108 **in-lbs**	8.1-12.2 Nm	2.47 HEADLAMP NACELLE: FLHR/C, Installation
Headlamp retaining ring screws (FLXH, FLHT/C/U)	23-28 **in-lbs**	2.6-3.2 Nm	7.11 HEADLAMP: ALL EXCEPT FLTR, Headlamp Assembly
Horn bracket acorn nut	80-120 **in-lbs**	9.0-13.6 Nm	7.27 HORN, Installation
Horn bracket to cylinder head screws	35-40 ft-lbs	48-54 Nm	4.13 INDUCTION MODULE, Installation/metric
Horn bracket to cylinder head screws	35-40 ft-lbs	48-54 Nm	7.35 MAIN WIRING HARNESS, Installation: All Models (Part 1)
Horn stud flange nut	80-100 **in-lbs**	9.0-11.3 Nm	7.27 HORN, Installation
Ignition coil screws	32-40 **in-lbs**	3.6-4.5 Nm	7.5 IGNITION COIL, Installation
Ignition switch housing nut	125-150 **in-lbs**	14.1-16.9 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR

FASTENER	TORQUE VALUE		NOTES
Ignition switch housing screws	36-60 **in-lbs**	4.1-6.8 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR
Ignition switch screws (FLHR/C)	20-30 **in-lbs**	2.3-3.4 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHR/C
Instrument bezel screws	25-35 **in-lbs**	2.8-4.0 Nm	7.20 INSTRUMENT NACELLE SWITCHES: FLTR, Installation
Instrument bezel screws (FLTR)	25-35 **in-lbs**	2.8-4.0 Nm	2.42 INSTRUMENT BEZEL: FLTR, Bezel
Instrument console screws	36-60 **in-lbs**	4.1-6.8 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHR/C
Instrument nacelle to fork bracket screws	15-20 ft-lbs	20-27 Nm	7.20 INSTRUMENT NACELLE SWITCHES: FLTR, Installation
Instrument nacelle to fork bracket screws	15-20 ft-lbs	20-27 Nm	7.20 INSTRUMENT NACELLE SWITCHES: FLTR, Installation
Instrument nacelle to fork bracket screws (FLTR)	15-20 ft-lbs	20-27 Nm	2.43 INSTRUMENT NACELLE: FLTR, Instrument Nacelle
Instrument nacelle to fork bracket screws (FLTR)	15-20 ft-lbs	20-27 Nm	2.43 INSTRUMENT NACELLE: FLTR, Instrument Nacelle
Jiffy stand bracket fasteners	36-42 ft-lbs	48.8-57.0 Nm	2.53 JIFFY STAND, Jiffy Stand Bracket
Jiffy stand interlock sensor fastener	96-120 **in-lbs**	10.8-13.6 Nm	2.53 JIFFY STAND, Jiffy Stand Interlock Sensor/Use Loctite Medium Strength Threadlocker 243 (blue) if reusing screw
Jiffy stand leg stop hex screw	15-20 ft-lbs	20.3-27.1 Nm	2.53 JIFFY STAND, Installation
Left electrical caddy fastener	72-96 **in-lbs**	8.1-10.8 Nm	2.51 REAR FRAME, Rear Frame
Left-side caddy mounting screws	72-96 **in-lbs**	8.1-10.9 Nm	7.7 ELECTRICAL CADDIES, Left Side Caddy
License plate bracket screws	60-80 **in-lbs**	6.8-9.0 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket
License plate bracket screws	60-80 **in-lbs**	6.8-9.0 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket
Lifter cover screws	90-120 **in-lbs**	10.2-13.6 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Push Rods, Lifters and Covers
Long post jam nut	65-80 **in-lbs**	7.3-9.0 Nm	7.10 STARTER SOLENOID, Solenoid Contacts
Lower fairing clip stud flange nuts	35-40 **in-lbs**	4.0-4.5 Nm	2.36 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU)
Lower fairing glove box tray T20 TORX screws	20-25 **in-lbs**	2.3-2.8 Nm	2.36 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU)
Lower fairing glove box tray T20 TORX screws	20-25 **in-lbs**	2.3-2.8 Nm	2.36 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU)
Lower fairing to engine guard clamp T40 TORX screws	90-100 **in-lbs**	10.2-11.3 Nm	2.36 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU)
Luggage rack fastener	15-20 ft lbs	20.3-27.1 Nm	2.31 TOUR-PAK, Luggage Rack/Tour-Pak Support
Luggage rack screws	15-20 ft-lbs	20-27 Nm	2.49 REAR FENDER, Installation
Mainshaft/countershaft nuts	55-65 ft-lbs	74.6-88.2 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Master cylinder reservoir cover	7-10 **in-lbs**	0.8-1.1 Nm	1.3 MAINTENANCE SCHEDULE, General
Master cylinder reservoir cover	12-15 **in-lbs**	1.4-1.7 Nm	1.3 MAINTENANCE SCHEDULE, General
Master cylinder reservoir handlebar clamp screws	72-84 **in-lbs**	8.1-9.5 Nm	2.14 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Mirror flange nut (FLHX)	30-40 **in-lbs**	3.4-4.5 Nm	2.27 MIRRORS, FLHX/metric

FASTENER	TORQUE VALUE		NOTES
Mirror stem acorn nut	60-96 **in-lbs**	6.8-10.8 Nm	2.27 MIRRORS, All Models Except FLHX/metric
Muffler clamp	38-43 ft-lbs	51.5-58.3 Nm	4.19 EXHAUST SYSTEM, Mufflers
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm	6.8 TRANSMISSION CASE, Installation
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm	7.24 NEUTRAL SWITCH, Installation
O2 sensor	30-44 ft-lbs	40.7-59.7 Nm	4.15 OXYGEN SENSORS (O2), Installation/metric
Oil pan fasteners	84-132 **in-lbs**	9.5-14.9 Nm	3.30 OIL PAN, Installation/Torque sequence
Oil pan tapered plug	18-22 ft-lbs	24.4-29.8 Nm	3.30 OIL PAN, Installation/Apply Loctite Pipe Sealant With Teflon 565 (P/N 99818-97)
Oil pressure sender	96-120 **in-lbs**	11-14 Nm	7.25 OIL PRESSURE SWITCH AND SENDER, Installation
Oil pressure switch	96-120 **in-lbs**	11-14 Nm	7.25 OIL PRESSURE SWITCH AND SENDER, Installation
Oil pump screws, initial torque	40-45 **in-lbs**	4.5-5.1 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Outer fairing long screws (FLTR)	10-15 **in-lbs**	1.1-1.7 Nm	2.41 UPPER FAIRING AND WINDSHIELD: FLTR, Outer Fairing
Outer fairing screws (FLHX, FLHT/C/U)	20-30 **in-lbs**	2.3-3.4 Nm	2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, Outer Fairing and Windshield
Outer fairing short screws (FLTR)	6-12 **in-lbs**	0.7-1.4 Nm	2.41 UPPER FAIRING AND WINDSHIELD: FLTR, Outer Fairing
Passenger footboard/footrest fastener	36-42 ft-lbs	48.8-56.9 Nm	2.52 FOOTBOARDS AND FOOTRESTS, Passenger Footboard
Passenger footboard/footrest fastener	36-42 ft-lbs	48.8-56.9 Nm	2.52 FOOTBOARDS AND FOOTRESTS, Passenger Footrest: FLHX
Passenger footrest pad socket head screw (FLHX)	15-20 ft-lbs	20-27 Nm	2.52 FOOTBOARDS AND FOOTRESTS, Passenger Footrest: FLHX/Use Loctite Medium Strength Threadlocker 243 (blue)
Piston jet screws	25-35 **in-lbs**	2.8-3.9 Nm	3.28 CRANKCASE, Right Crankcase Half
Primary cam sprocket flange bolts, final torque	34 ft-lbs	46.1 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Primary cam sprocket flange bolts, initial torque	15 ft-lbs	20.3 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Primary cam sprocket flange bolts, initial torque	15 ft-lbs	20.3 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.3 MAINTENANCE SCHEDULE, General
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.7 PRIMARY CHAIN, Chaincase Lubricant
Primary cover fasteners	108-120 **in-lbs**	12.2-13.6 Nm	5.3 PRIMARY CHAINCASE COVER, Installation/See sequence in the procedure
Radio (storage box) to support bracket screws	35-45 **in-lbs**	4.0-5.1 Nm	7.33 ADVANCED AUDIO SYSTEM, Radio (Storage Box)
Radio bracket/inner fairing to fairing bracket stud locknuts (FLTR)	96-144 **in-lbs**	10.9-16.3 Nm	2.44 INNER FAIRING: FLTR, Installation
Radio mounting screw	35-45 **in-lbs**	4.0-5.1 Nm	7.35 MAIN WIRING HARNESS, Installation: FLHX, FLHT/C/U (Part 2)
Radio support bracket screws	35-45 **in-lbs**	4.0-5.1 Nm	7.18 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR
Rail clamp screws	30-50 **in-lbs**	3.0-6.0 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail

FASTENER	TORQUE VALUE		NOTES
Rear axle cone nut	15-20 ft-lbs	20-27 Nm	1.13 REAR BELT DEFLECTION, Setting Belt Deflection/For belt adjustment only
Rear axle cone nut	95-105 ft-lbs	128.8-142.4 Nm	1.13 REAR BELT DEFLECTION, Setting Belt Deflection
Rear axle cone nut (preliminary)	15-20 ft-lbs	20-27 Nm	2.5 REAR WHEEL, Installation/metric
Rear brake light switch	12-15 ft-lbs	16.3-20.3 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped/Use Loctite Pipe Sealant with Teflon 565
Rear brake light switch	12-15 ft-lbs	16.3-20.3 Nm	C.3 ABS BRAKE LINES, Rear Master Cylinder to ABS Module/Use Loctite Pipe Sealant with Teflon 565
Rear cylinder head exhaust flange nut	9-18 **in-lbs**	1-2 Nm	4.19 EXHAUST SYSTEM, System Installation
Rear fascia flange nuts (FLHX)	30-45 **in-lbs**	3.4-5.1 Nm	2.50 REAR FASCIA: FLHX, Installation
Rear fascia flange nuts (FLHX)	30-45 **in-lbs**	3.4-5.1 Nm	2.50 REAR FASCIA: FLHX, Stud Plate
Rear fascia lamp screws (FLHX)	18-22 **in-lbs**	2.0-2.5 Nm	2.50 REAR FASCIA: FLHX, Installation
Rear fender lights harness stud plate flange nuts	60-96 **in-lbs**	6.8-10.9 Nm	7.14 TAIL LAMP, Rear Fender Lights Harness
Rear fender mounting screws	15-20 ft-lbs	20-27 Nm	2.49 REAR FENDER, Installation
Rear fender support-to-fender nut	45-85 **in-lbs**	5.1-9.6 Nm	2.50 REAR FASCIA: FLHX, Stud Plate
Rear fender support -to-saddlebag support fastener	15-20 ft-lbs	20-27 Nm	2.49 REAR FENDER, Installation
Rear fender support-to-saddlebag support fastener	15-20 ft-lbs	20.3-27.1 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Rear fender support-to-saddlebag support fastener	15-20 ft-lbs	20.3-27.1 Nm	2.50 REAR FASCIA: FLHX, Stud Plate
Rear fender tip lamp screws	20-25 **in-lbs**	2.3-2.8 Nm	7.15 FENDER TIP LAMPS, Rear Fender Tip Lamp
Rear fork bracket bolts	55-65 ft-lbs	74.6-88.1 Nm	2.24 REAR FORK, Installation/Apply two drops of Loctite Medium Strength Threadlocker 243 (blue) to threads
Rear fork pivot shaft nuts	55-66 ft-lbs	74.6-89.5 Nm	2.24 REAR FORK, Installation/Apply two drops of Loctite Medium Strength Threadlocker 243 (blue) to threads
rear frame fastener	40-50 ft-lbs	54.2-67.8 Nm	2.51 REAR FRAME, Rear Frame
Rear frame-to-main frame fastener	40-50 ft-lbs	54.2-67.8 Nm	1.24 ENGINE MOUNTS, Inspection
Rear master cylinder reservoir cover screws	12-15 **in-lbs**	1.4-1.7 Nm	1.14 BRAKES, Fluid Inspection
Rear master cylinder reservoir cover screws	12-15 **in-lbs**	1.4-1.7 Nm	1.15 BRAKE PADS AND DISCS, Brake Pad Replacement
Rear master cylinder reservoir cover screws	12-15 **in-lbs**	1.4-1.7 Nm	1.16 BLEEDING BRAKES, Procedure
Rear master cylinder to engine mount end cap screws	10.5-12.5 ft-lbs	14-17 Nm	2.16 REAR BRAKE MASTER CYLINDER, Assembly and Installation
Rear master cylinder-to-frame screws	126-150 **in-lbs**	14.2-17.0 Nm	2.16 REAR BRAKE MASTER CYLINDER, Rear Brake Line: Non-ABS Equipped
Rear master cylinder-to-frame screws	126-150 **in-lbs**	14.2-17.0 Nm	C.3 ABS BRAKE LINES, Rear Master Cylinder to ABS Module
Rear muffler fastener	96-144 **in-lbs**	10.9-16.3 Nm	1.13 REAR BELT DEFLECTION, Setting Belt Deflection

FASTENER	TORQUE VALUE		NOTES
Rear muffler fastener	96-144 **in-lbs**	10.8-16.3 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Rear muffler fastener	96-144 **in-lbs**	10.8-16.3 Nm	4.19 EXHAUST SYSTEM, Mufflers
Rear stoplight switch	12-15 ft-lbs	16.3-20.3 Nm	7.26 STOPLIGHT SWITCHES, Rear Stoplight Switch/Use Loctite Pipe Sealant with Teflon 565
Rear turn signal lamps bracket screws	84-144 **in-lbs**	9.5-16.3 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket/Use LOCTITE High Strength Threadlocker 271 (red)
Rear turn signal lamps bracket screws	84-144 **in-lbs**	9.5-16.3 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket/Use LOCTITE High Strength Threadlocker 271 (red)
Rear turn signal lamp to rear turn signal lamps bracket screws	30-50 **in-lbs**	3.4-5.6 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamp
Rider footboard bracket socket screws	36-42 ft-lbs	48.8-57.0 Nm	2.52 FOOTBOARDS AND FOOTRESTS, Rider Footboards
Rider footboard pivot bolt nut	60-80 **in-lbs**	6.8-9.0 Nm	2.52 FOOTBOARDS AND FOOTRESTS, Rider Footboards
Rocker arm support plate bolts	18-22 ft-lbs	24.4-29.8 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate
Rocker cover bolts	15-18 ft-lbs	20.3-24.4 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly
Rocker housing bolts	120-168 **in-lbs**	13.6-19.0 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head
Saddlebag latch/check strap T15 TORX screws	20-25 **in-lbs**	2.3-2.8 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Hardware
Saddlebag latch/check strap T15 TORX screws	20-25 **in-lbs**	2.3-2.8 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Hardware
Saddlebag lid check strap T20 TORX screws	18-20 **in-lbs**	2.0-2.3 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Hardware
Saddlebag mounting bracket screw	60-96 **in-lbs**	6.8-10.8 Nm	2.28 SEAT, Seat: FLHR/C
Saddlebag mounting bracket screw	12-15 ft-lbs	16.3-20.3 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Saddlebag mounting bracket screw	12-15 ft-lbs	16.3-20.3 Nm	2.49 REAR FENDER, Installation
Saddlebag mounting bracket screw fastener	12-15 ft lbs	16.3-20.3 Nm	2.31 TOUR-PAK, Luggage Rack/Tour-Pak Support
Saddlebag mounting bracket to saddlebag support screws	12-15 ft-lbs	16.3-20.3 Nm	2.29 SADDLEBAGS, Installation
Saddlebag side guard to front guard screw	72-120 **in-lbs**	8.0-14.0 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Saddlebag support rail to front guard screw	70-100 **in-lbs**	8.0-11.0 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Saddlebag support to fender support fastener	15-20 ft-lbs	20.0-27.0 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Saddlebag support to fender support fastener	15-20 ft-lbs	20-27 Nm	2.49 REAR FENDER, Installation
Sealing fasteners	25-27 ft-lbs	33.9-36.6 Nm	5.5 PRIMARY CHAINCASE HOUSING, Installation
Seat mounting screw	48-72 **in-lbs**	5.4-8.1 Nm	2.28 SEAT, Seat: FLHT, FLTR, FLHX
Seat mounting screw	48-72 **in-lbs**	5.4-8.1 Nm	2.28 SEAT, Seat: FLHTC/U

FASTENER	TORQUE VALUE		NOTES
Seat mounting screw	48-72 **in-lbs**	5.4-8.1 Nm	2.28 SEAT, Seat: FLHR/C
Seat strap screw	48-72 **in-lbs**	5.4-8.1 Nm	2.28 SEAT, Seat: FLHT, FLTR, FLHX
Seat strap screw	48-72 **in-lbs**	5.4-8.1 Nm	2.28 SEAT, Seat: FLHTC/U
Secondary cam chain tensioner fastener	100-120 **in-lbs**	11.3-13.6 Nm	3.26 CAM SUPPORT PLATE AND COVER, Camshafts
Shift drum detent arm fastener	120-150 **in-lbs**	13.6-17.0 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shift drum lock plate fasteners	57-63 **in-lbs**	6.4-7.1 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shifter rod lever screw	18-22 ft-lbs	24.4-29.8 Nm	6.8 TRANSMISSION CASE, Assembly
Shifter rod locknut	80-120 **in-lbs**	9.0-13.6 Nm	6.4 SHIFTER LINKAGE, Shifter Rod
Shift lever fasteners	18-22 ft-lbs	24-30 Nm	5.3 PRIMARY CHAINCASE COVER, Installation
Shift lever shaft fastener	90-110 **in-lbs**	10.2-12.4	5.3 PRIMARY CHAINCASE COVER, Installation
Shock lower mounting bolt	35-40 ft-lbs	47.5-54.2 Nm	2.23 REAR SHOCK ABSORBERS, Installation/Use LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (blue)
Shock lower mounting bolt	35-40 ft-lbs	47-54 Nm	2.24 REAR FORK, Installation/Apply two or three drops of Loctite Medium Strength Threadlocker 243 (blue) to threads
Shock upper mounting bolt	35-40 ft-lbs	47.5-54.2 Nm	2.23 REAR SHOCK ABSORBERS, Installation/Use LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (blue)
Side door fasteners	13-18 ft-lbs	17.6-24.4 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Side rail to saddlebag support screws	15-20 ft-lbs	20.0-27.0 Nm	2.30 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail
Solenoid ring terminal nut	70-90 **in-lbs**	7.9-10.2 Nm	7.9 STARTER, Field Coil Assembly
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.3 MAINTENANCE SCHEDULE, General
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.20 SPARK PLUGS, Inspection
Speaker box mounting bolts	25-35 **in-lbs**	2.8-4.0 Nm	2.31 TOUR-PAK, Removal/Installation
Speedometer/tachometer bracket screws	10-20 **in-lbs**	1.1-2.3 Nm	2.39 INNER FAIRING: FLHX, FLHT/C/U, Installation
Speedometer bracket screws	10-20 **in-lbs**	1.1-2.3 Nm	7.29 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR, Speedometer
Spoke nipple	55 **in-lbs**	6.2 Nm	1.3 MAINTENANCE SCHEDULE, General
Spoke nipple	55 **in-lbs**	6.2 Nm	1.10 TIRES AND WHEELS, Wheel Spokes
Spoke nipple	55 **in-lbs**	6.2 Nm	2.8 WHEEL LACING: 16 INCH FRONT RIM, Procedure
Spoke nipple	55 **in-lbs**	6.2 Nm	2.9 WHEEL LACING: 16 INCH REAR RIM, Procedure
Spoke nipple	55 **in-lbs**	6.2 Nm	2.10 WHEEL LACING: 17 INCH RIM, Procedure
Spoke nipple	55 **in-lbs**	6.2 Nm	2.12 TRUING LACED WHEELS, Radial Truing
Starter end cover screw	90-110 **in-lbs**	10.2-12.4 Nm	7.9 STARTER, Field Coil Assembly
Starter mounting screw	22-24 ft-lbs	29.8-32.5 Nm	7.9 STARTER, Installation
Starter terminal post nut	70-90 **in-lbs**	7.9-10.2 Nm	7.9 STARTER, Installation
Starter thru bolts	39-65 **in-lbs**	4.4-7.3 Nm	7.9 STARTER, Field Coil Assembly
Stator mounting screws	55-75 **in-lbs**	6.2-8.5 Nm	7.22 ALTERNATOR, Installation/Always use new screws

FASTENER	TORQUE VALUE		NOTES
Tachometer bracket screws	10-20 **in-lbs**	1.1-2.3 Nm	7.29 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR, Tachometer
Tail lamp circuit board/chrome base screw	40-48 **in-lbs**	4.5-5.4 Nm	7.14 TAIL LAMP, Circuit Board/Chrome Base
Tail lamp screws	20-24 **in-lbs**	2.3-2.7 Nm	7.14 TAIL LAMP, Tail Lamp/Tail Lamp Bulb
Tail lamp screws	20-24 **in-lbs**	2.3-2.7 Nm	7.14 TAIL LAMP, Circuit Board/Chrome Base
Tail lamp screws	20-24 **in-lbs**	2.3-2.7 Nm	7.14 TAIL LAMP, Rear Fender Lights Harness
Tail lamp screws	20-24 **in-lbs**	2.3-2.7 Nm	7.15 FENDER TIP LAMPS, Rear Fender Tip Lamp
Tail lamp screws	20-24 **in-lbs**	2.3-2.7 Nm	7.16 TURN SIGNAL LAMPS, Rear Turn Signal Lamp
TMAP hex screw	84-108 **in-lbs**	9.5-12.2 Nm	4.14 TEMPERATURE MANIFOLD ABSOLUTE PRESSURE SENSOR (TMAP), Installation/metric
Top caddy clamp screws	72-96 **in-lbs**	8.1-10.9 Nm	7.7 ELECTRICAL CADDIES, Top Caddy
Top caddy fastener	72-96 **in-lbs**	8.1-10.8 Nm	2.51 REAR FRAME, Rear Frame
Top caddy hold-down	32-40 **in-lbs**	3.6-4.5 Nm	4.22 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister
Top caddy mounting screw	72-96 **in-lbs**	8.1-10.9 Nm	1.3 MAINTENANCE SCHEDULE, General
Top caddy mounting screw	72-96 **in-lbs**	8.1-10.9 Nm	1.17 BATTERY MAINTENANCE, Battery
Top engine mounting bracket stabilizer link to frame weldment bolt	30-35 ft-lbs	41-48 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Top engine mounting bracket stabilizer link to frame weldment bolt	30-35 ft-lbs	41-48 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Top engine mounting bracket to front cylinder head bolts	30-35 ft-lbs	41-48 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Top engine mounting bracket to front cylinder head bolts	30-35 ft-lbs	41-48 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Tour-Pak lockset hex nut	25-35 **in-lbs**	2.8-4.0 Nm	2.32 TOUR-PAK SERVICE, Lockset
Tour-Pak lockset hex nut	25-35 **in-lbs**	2.8-4.0 Nm	2.35 TOUR-PAK SPEAKER BOX: FLHTCU, Speaker Box (FLHTCU)
Tour-Pak lockset jam nut	30-45 **in-lbs**	3.4-5.1 Nm	2.32 TOUR-PAK SERVICE, Lockset
Tour-Pak metal plate flange nuts	65-70 **in-lbs**	7.3-7.9 Nm	2.33 TOUR-PAK LIGHTS, Tour-Pak Lights Harness
Tour-Pak mounting bolts	96-120 **in-lbs**	10.8-13.6 Nm	2.31 TOUR-PAK, Removal/Installation
Tour-Pak mounting bolts	96-120 **in-lbs**	10.8-13.6 Nm	2.31 TOUR-PAK, Adjustment
Tour-Pak mounting bolts	96-120 **in-lbs**	10.8-13.6 Nm	2.33 TOUR-PAK LIGHTS, Tour-Pak Lights Harness
Tour-Pak passenger backrest flange nuts	40-60 **in-lbs**	4.5-6.8 Nm	2.32 TOUR-PAK SERVICE, Tether Brackets
Tour-Pak passenger backrest flange nuts	40-60 **in-lbs**	4.5-6.8 Nm	2.34 TOUR-PAK BACKREST, Passenger Backrest
Tour-Pak passenger backrest flap T25 TORX screws	21-24 **in-lbs**	2.4-2.7 Nm	2.34 TOUR-PAK BACKREST, Passenger Backrest Flap (FLHTCU)
Tour-Pak side marker lights T15 TORX screws	20-25 **in-lbs**	2.3-2.8 Nm	2.33 TOUR-PAK LIGHTS, Side Marker Lights (FLHTCU)
Tour-Pak tether T15 TORX screw	20-25 **in-lbs**	2.3-2.8 Nm	2.32 TOUR-PAK SERVICE, Hinges/Use Loctite High Strength Threadlocker 262 (red)
Tour-Pak tether T15 TORX screw	20-25 **in-lbs**	2.3-2.8 Nm	2.32 TOUR-PAK SERVICE, Latches/Lockset Catch/Use Loctite Medium Strength Threadlocker 243 (blue)

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FASTENER	TORQUE VALUE		NOTES
Tour-Pak tether T15 TORX screw	20-25 **in-lbs**	2.3-2.8 Nm	2.32 TOUR-PAK SERVICE, Latches/Lockset Catch/Use Loctite Medium Strength Threadlocker 243 (blue)
Tour-Pak tether T15 TORX screw	20-25 **in-lbs**	2.3-2.8 Nm	2.32 TOUR-PAK SERVICE, Tether/Use Loctite High Strength Threadlocker 262 (red)
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.3 MAINTENANCE SCHEDULE, General
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.8 TRANSMISSION LUBRICANT, Transmission Lubrication
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	3.30 OIL PAN, Installation/Clean plug before installation
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.8 TRANSMISSION CASE, Installation
Transmission filler/check plug	25-75 **in-lbs**	2.8-8.5 Nm	1.3 MAINTENANCE SCHEDULE, General
Transmission filler/check plug	25-75 **in-lbs**	2.8-8.5 Nm	1.8 TRANSMISSION LUBRICANT, Transmission Lubrication
Transmission filler/check plug	25-75 **in-lbs**	2.8-8.5 Nm	1.8 TRANSMISSION LUBRICANT, Transmission Lubrication
Transmission lockplate screws	84-132 **in-lbs**	9.5-14.9 Nm	5.7 TRANSMISSION SPROCKET, Installation/LOCTITE patch, use 3-5 times
Transmission lubricant drain plug	14-21 ft-lbs	19-28 Nm	2.25 CLUTCH CABLE, Installation
Transmission mounting bolts, final torque	34-39 ft-lbs	46.1-52.9 Nm	6.8 TRANSMISSION CASE, Installation
Transmission mounting bolts, initial torque	15 ft-lbs	20.3 Nm	6.8 TRANSMISSION CASE, Installation
Transmission sprocket nut	100 ft-lbs	136.0 Nm	5.7 TRANSMISSION SPROCKET, Installation/Right hand threads, initial torque only, apply several drops of LOCTITE THREADLOCKER 271 (red) to last few threads.
Transmission sprocket nut	35 ft-lbs	47.5 Nm	5.7 TRANSMISSION SPROCKET, Installation/Plus an additional 35-45 degrees final torque
Transmission to crankcase bolts	15 ft-lbs	20.3 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission to crankcase bolts	34-39 ft-lbs	46.1-52.9 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission top cover	84-132 **in-lbs**	9.5-14.9 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Turn signal lamp fastener: FLHX	15-20 ft-lbs	20-27 Nm	7.16 TURN SIGNAL LAMPS, Front Turn Signal Lamp
Turn signal lamp to auxiliary lamp bracket mount socket screws	36-60 **in-lbs**	4.1-6.8 Nm	7.13 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Housing
Turn signal lamp to auxiliary lamp stud locknut	15-18 ft-lbs	20.3-24.4 Nm	7.13 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Housing
Turn signal lamp to mounting bracket screws	36-60 **in-lbs**	4.1-6.8 Nm	1.23 HEADLAMP ALIGNMENT, Auxiliary Lamp Alignment
Valve stem nut	12-15 **in-lbs**	1.4-1.7 Nm	2.18 TIRES, Installation
Voltage regulator locknuts	70-100 **in-lbs**	7.9-11.3 Nm	7.3 VOLTAGE REGULATOR, Installation
VSS fastener	84-132 **in-lbs**	9.5-14.9 Nm	6.8 TRANSMISSION CASE, Installation
VSS Screw	84-132 **in-lbs**	9.5-14.9 Nm	7.23 VEHICLE SPEED SENSOR (VSS), VSS
Windshield screws (FLHX, FLHT/C/U)	25-30 **in-lbs**	2.8-3.4 Nm	2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, Outer Fairing and Windshield

FASTENER	TORQUE VALUE		NOTES
Windshield wellnut screws (FLTR)	6-13 **in-lbs**	0.7-1.5 Nm	2.41 UPPER FAIRING AND WINDSHIELD: FLTR, Windshield
Windshield window T27 TORX screws (Road King Models)	20-25 **in-lbs**	2.3-2.8 Nm	2.46 WINDSHIELD: FLHR/C, Windshield Window

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DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

2009 Harley-Davidson Touring Models
Electrical Diagnostic Manual

99497-09

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IMPORTANT NOTICE

Harley-Davidson motorcycles conform to all applicable U.S.A. Federal Motor Vehicle Safety Standards and U.S.A. Environmental Protection Agency regulations effective on the date of manufacture.

To maintain the safety, dependability, and emission and noise control performance, it is essential that the procedures, specifications and service instructions in this manual are followed.

Any substitution, alteration or adjustment of emission system and noise control components outside of factory specifications may be prohibited by law.

Harley-Davidson Motor Company

READER COMMENTS

The Harley-Davidson Service Communications Department maintains a continuous effort to improve the quality and usefulness of its publications. To do this effectively, we need user feedback - your critical evaluation of this manual.

Please comment on the completeness, accuracy, organization, usability, and readability of this manual.

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2009 Harley-Davidson Touring Models Electrical Diagnostic Manual (99497-09)

Please clip out and mail to:
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P.O. Box 653
Milwaukee, WI USA 53201

NOTES

ABOUT THIS MANUAL

GENERAL

This electrical diagnostic service manual has been prepared with two purposes in mind. First, it will acquaint the user with the construction of the Harley-Davidson product and assist in the performance of repair. Secondly, it will introduce to the professional Harley-Davidson Technician the latest field-tested and factory-approved diagnostic methods. We sincerely believe that this manual will make your association with Harley-Davidson products more pleasant and profitable.

HOW TO USE YOUR SERVICE MANUAL

Refer to the table below for the content layout of this manual.

NO.	CHAPTER
1	Starting / Charging
2	Instruments
3	TSM/HFSM
4	Engine Management
5	Audio System
6	ABS
A	Appendix A Connector Repair
B	Appendix B Wiring
C	Appendix C Conversions
D	Appendix D Glossary
E	Appendix E TSM/TSSM (Japan/Korea)

Use the TABLE OF CONTENTS (which follows this FOREWORD) and the INDEX (at the back of this manual) to quickly locate subjects. Sections and topics in this manual are sequentially numbered for easy navigation.

For example, a cross-reference shown as **2.1 SPECIFICATIONS** refers to chapter 2 CHASSIS, heading 2.1 SPECIFICATIONS.

For quick and easy reference, all pages contain a section number followed by a page number. For example, **page 3-5** refers to page 5 in section 3.

A number of acronyms and abbreviations are used in this document. See the D.1 GLOSSARY for a list of acronyms, abbreviations and definitions.

PREPARATION FOR SERVICE

⚠WARNING

Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

Good preparation is very important for efficient service work. A clean work area at the start of each job will allow you to perform the repair as easily and quickly as possible, and will reduce the incidence of misplaced tools and parts. A motorcycle that is excessively dirty should be cleaned before work starts. Cleaning will occasionally uncover sources of trouble. Tools, instruments and any parts needed for the job should be gathered before work is started. Interrupting a job to locate tools or parts is a distraction and causes needless delay.

NOTES

- *To avoid unnecessary disassembly, carefully read all relative service information before repair work is started.*
- *In figure legends, the number which follows the name of a part indicates the quantity necessary for one complete assembly.*
- *When servicing a vehicle equipped with the Harley-Davidson Smart Security System (H-DSSS), you must first disarm the security system. Either keep the fob in close proximity to the vehicle, or use Digital Technician II to disable the security system while the vehicle is being serviced and re-enable the system after service is completed.*

SERVICE BULLETINS

In addition to the information presented in this Service Manual, Harley-Davidson Motor Company will periodically issue Service Bulletins to Harley-Davidson dealers. Service Bulletins cover interim engineering changes and supplementary information. Consult the Service Bulletins to keep your product knowledge current and complete.

USE GENUINE REPLACEMENT PARTS

⚠WARNING

Do not use aftermarket parts and custom made front forks which can adversely affect performance and handling. Removing or altering factory installed parts can adversely affect performance and could result in death or serious injury. (00001a)

To ensure satisfactory and lasting repairs, carefully follow the Service Manual instructions and use only genuine Harley-Davidson replacement parts. Behind the emblem bearing the words GENUINE HARLEY-DAVIDSON stand more than 100 years of design, research, manufacturing, testing and inspecting experience. This is your assurance that the parts you are using will fit right, operate properly and last longer.

WARNINGS AND CAUTIONS

Statements in this service manual preceded by the following words are of special significance.

⚠WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. (00119a)

⚠CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. (00139a)

CAUTION

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage. (00140a)

NOTE

Refers to important information, and is placed in italic type. It is recommended that you take special notice of these items.

Proper service and repair is important for the safe, reliable operation of all mechanical products. The service procedures recommended and described in this service manual are effective methods for performing service operations.

⚠WARNING

Always wear proper eye protection when using hammers, arbor or hydraulic presses, gear pullers, spring compressors, slide hammers and similar tools. Flying parts could result in death or serious injury. (00496b)

Some of these service operations require the use of tools specially designed for the purpose. These special tools should be used when and as recommended. It is important to note that some warnings against the use of specific service methods, which could damage the motorcycle or render it unsafe, are stated in this service manual. However, please remember that these warnings are not all-inclusive. Inadequate safety precautions could result in death or serious injury.

Since Harley-Davidson could not possibly know, evaluate or advise the service trade of all possible ways in which service might be performed, or of the possible hazardous consequences of each method, we have not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by Harley-Davidson must first thoroughly satisfy himself that neither his nor the operator's safety will be jeopardized as a result. Failure to do so could result in death or serious injury.

PRODUCT REFERENCES

⚠WARNING

Read and follow warnings and directions on all products. Failure to follow warnings and directions can result in death or serious injury. (00470b)

When reference is made in this manual to a specific brand name product, tool or instrument, an equivalent product, tool or instrument may be substituted.

Kent-Moore Products

All tools mentioned in this manual with an "HD", "J" or "B" preface must be ordered through SPX Kent-Moore. For ordering information or product returns, warranty or otherwise, visit www.spx.com.

Loctite Sealing and Threadlocking Products

Some procedures in this manual call for the use of Loctite products. If you have any questions regarding Loctite product usage or retailer/wholesaler locations, please contact Loctite Corp. at www.loctite.com.

PRODUCT REGISTERED MARKS

Alcantara S.p.A., Allen, Amp Multilock, Bluetooth, Brembo, Delphi, Deutsch, Dunlop, Dynojet, Fluke, G.E. Versilube, Gunk, Hydroseal, Hylomar, Kevlar, Lexan, Loctite, Lubriplate, Keps, K&N, Magnaflux, Marson Thread-Setter Tool Kit, MAXI fuse, Molex, MPZ, Mulitilock, Novus, Packard, Pirelli, Permatex, Philips, PJ1, Pozidriv, Robinair, S100, Sems, Snap-on, Teflon, Threadlocker, Torca, Torco, TORX, Tufoil, Tyco, Ultratorch, Velcro, X-Acto, and XM Satellite Radio are among the trademarks of their respective owners.

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Harley, Harley-Davidson, H-D, Bar & Shield, Cross Bones, Digital Tech, Digital Technician, Digital Technician II, Dyna, Electra Glide, Evolution, Fat Bob, Fat Boy, Glaze, Gloss, H-D, H-Dnet.com, HD, Harley, Harley-Davidson, Heritage Softail, Low Rider, Night Rod, Nightster, Night Train, Profile, Revolution, Road Glide, Road King, Road Tech, Rocker, Softail, Sportster, Street Glide, Street Rod, Sun Ray, Sunwash, Tech Link, Twin Cam 88, Twin Cam 88B, Twin Cam 96, Twin Cam 96B, Twin Cam 103, Twin Cam 103B, Twin Cam 110, Twin Cam 110B, Tour-Pak, Screamin' Eagle, Softail, Super Glide, SYN3, Ultra Classic, V-Rod, VRSC and Harley-Davidson Genuine Motor Parts and Genuine Motor Accessories are among the trademarks of H-D Michigan, Inc.

CONTENTS

All photographs, illustrations and procedures may not necessarily depict the most current model or component, but are based on the latest production information available at the time of publication.

Since product improvement is our continual goal, Harley-Davidson reserves the right to change specifications, equipment or designs at any time without notice and without incurring obligation.

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NOTES

STARTER TROUBLESHOOTING 1.1

GENERAL

The troubleshooting tables contain detailed procedures to solve and correct problems. Follow 1.2 STARTING SYSTEM DIAGNOSIS to diagnose starting system problems. The 1.3 DIAGNOSTICS/TROUBLESHOOTING, Voltage Drop procedure helps you to locate poor connections or components with excessive voltage drops.

STARTER TROUBLESHOOTING

Table 1-1. Starter Does Not Run or Runs at Very Low Speeds

SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
Battery	Voltage drop due to discharged battery.	Charge battery.
	Short-circuit or open between electrodes.	Replace battery.
	Poor contact condition of battery terminal(s).	Clean and re-tighten.
Wiring	Poor or no connection at either end of the battery positive or negative cable.	Repair or replace cable(s).
	Cracked or corroded battery cable ends.	Clean, tighten or replace cable(s) as needed.
	Open wire(s) or poor connection at handlebar switch or start relay, especially relay ground wire (grounds through TSM/TSSM/HFSM).	Tighten connections or repair or replace wire(s).
Start switch, clutch switch, engine stop switch or neutral switch	Poor switch contacts or open switch.	Replace switch.
Start relay	Open coil winding.	Replace relay.
	Poor or no continuity at relay points.	Replace relay.
	TSM/TSSM/HFSM has disabled starter relay.	Disarm security system.
Solenoid	Poor contact condition caused by burned contact.	Polish contact surface or replace solenoid assembly.
	Pull-in winding open or short-circuited.	Repair or replace solenoid assembly.
	Hold-in winding open or short-circuited.	Repair or replace solenoid assembly.
Starting motor	Brushes worn below specification.	Check brush spring tension. Replace field frame and holder.
	Commutator burned.	Re-face or replace.
	Commutator high mica.	Correct by undercutting.
	Field winding grounded.	Replace starter.
	Armature winding grounded or short-circuited.	Replace armature.
	Free running current draw out of range.	Replace starter.
	Reduction gears damaged.	Replace starter.
	Insufficient brush spring tension.	Replace starter.
	Disconnected lead wire between solenoid and field windings.	Repair or replace lead wire.
	Ball bearing sticks.	Replace bearing.
Temperature	Incorrect oil for low temperature.	Use recommended viscosity oil for temperature range. Consult Owner's Manual.

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Table 1-2. Pinion Does Not Engage With Ring Gear While Starter is Cranked or Engine Cannot Be Cranked

SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
Battery	Voltage drop due to discharged battery.	Charge battery.
	Short-circuit or open between electrodes.	Replace battery.
	Poor contact condition of battery terminal(s).	Clean and re-tighten.
Overrunning clutch	Overrunning clutch malfunction (rollers or compression spring).	Replace overrunning clutch.
	Pinion teeth worn out.	Replace starter clutch subassembly.
	Pinion does not run in overrunning direction.	Replace overrunning clutch.
	Poor sliding condition of spline teeth.	Remove foreign materials, dirt or replace overrunning clutch or pinion shaft.
	Reduction gears damaged.	Replace overrunning clutch and idler gear.
Gear teeth on clutch shell	Excessively worn teeth.	Replace clutch shell.

Table 1-3. Starter Does Not Stop Running

SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
Start switch or start relay	Unopened contacts.	Replace start switch or start relay.
	Poor return caused by sticky switch or relay contacts.	Replace start switch or start relay.
Gear teeth on clutch shell	Excessively worn teeth.	Replace clutch shell.
Solenoid	Return spring worn.	Replace spring.
	Coil layer shorted.	Replace solenoid.
	Contact plate melted and stuck.	Replace solenoid.

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STARTING SYSTEM DIAGNOSIS 1.2

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. See 1.3 DIAGNOSTICS/TROUBLESHOOTING, Voltage Drop.
2. Remove starter motor. Connect jumper wires as described in 1.6 TESTING STARTER ON BENCH, Free Running Current Draw Test.
3. Connect BREAKOUT BOX (Part No. HD-42682) to TSM/TSSM/HFSM as follows:
 a. On models with a TSM/HFSM, see 3.12 BREAKOUT BOX: TSM/HFSM.
 b. On models with a TSSM (Japan/Korea), E.11 BREAKOUT BOX: TSM/TSSM.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) purple terminal pin probe and patch cord.
5. See 1.5 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.
6. See 1.6 TESTING STARTER ON BENCH, Free Running Current Draw Test.
7. Closely inspect handlebar controls for pinched wiring.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

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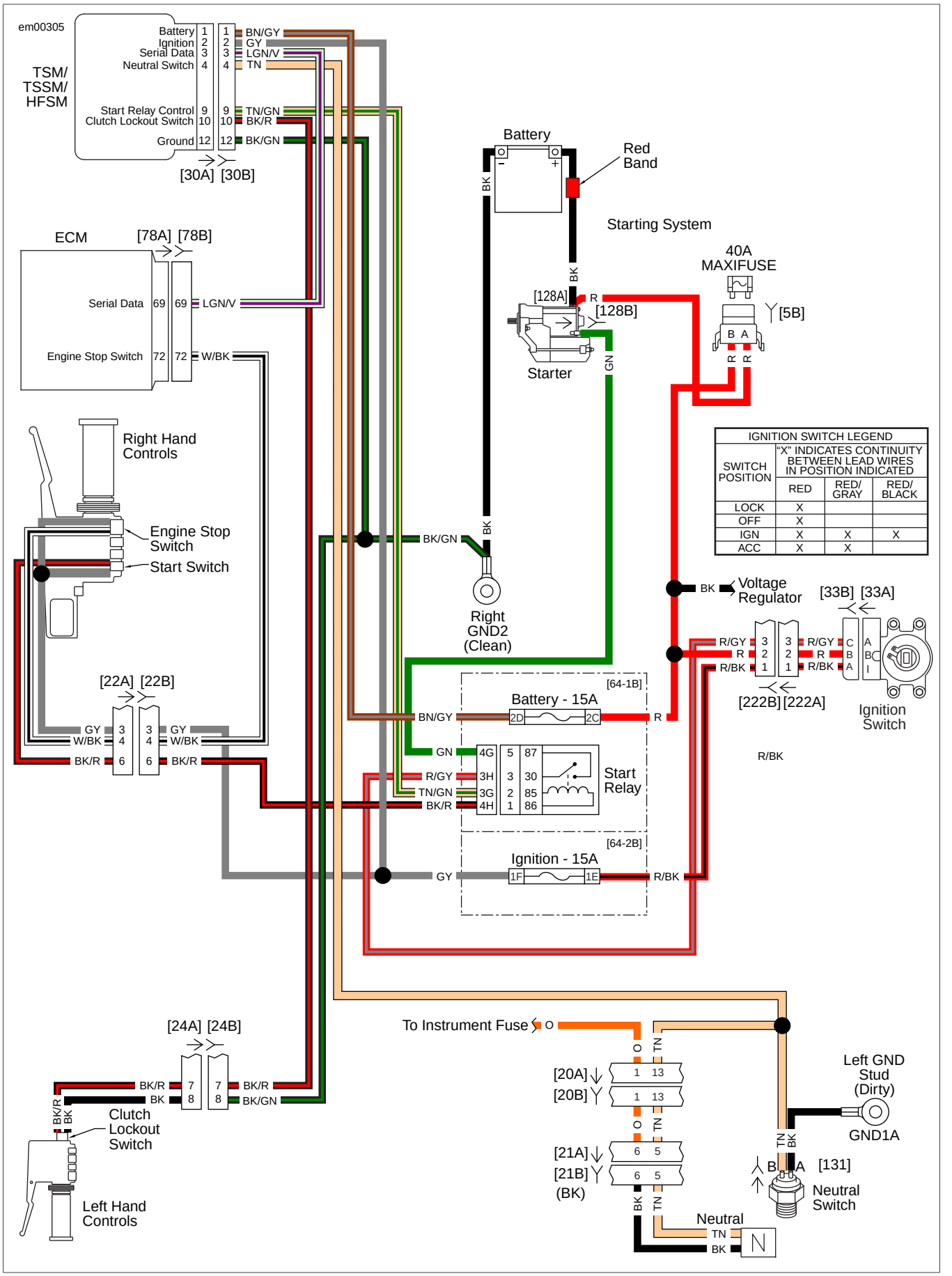


Figure 1-1. Starting Circuit (FLHR/C/S)

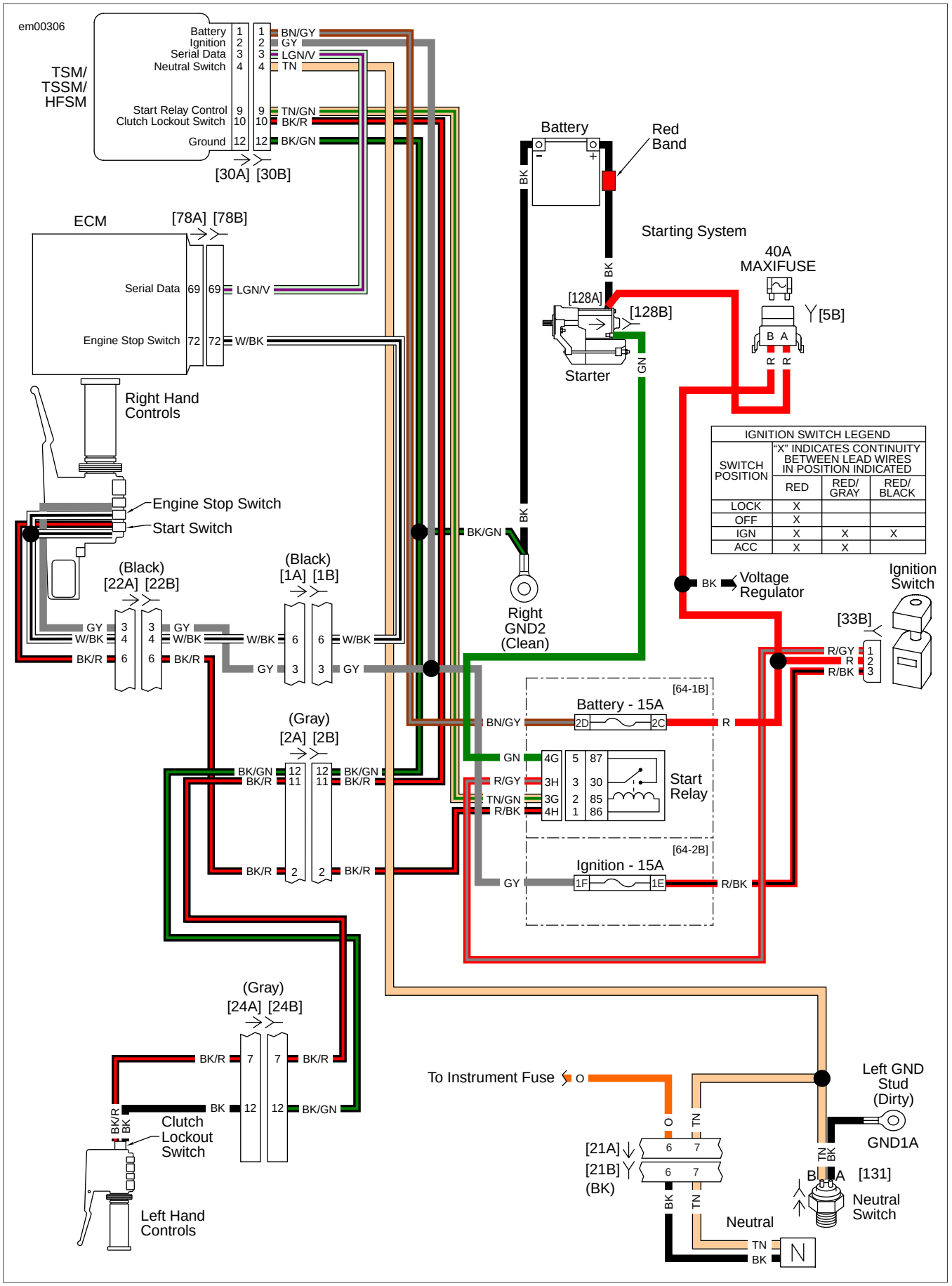


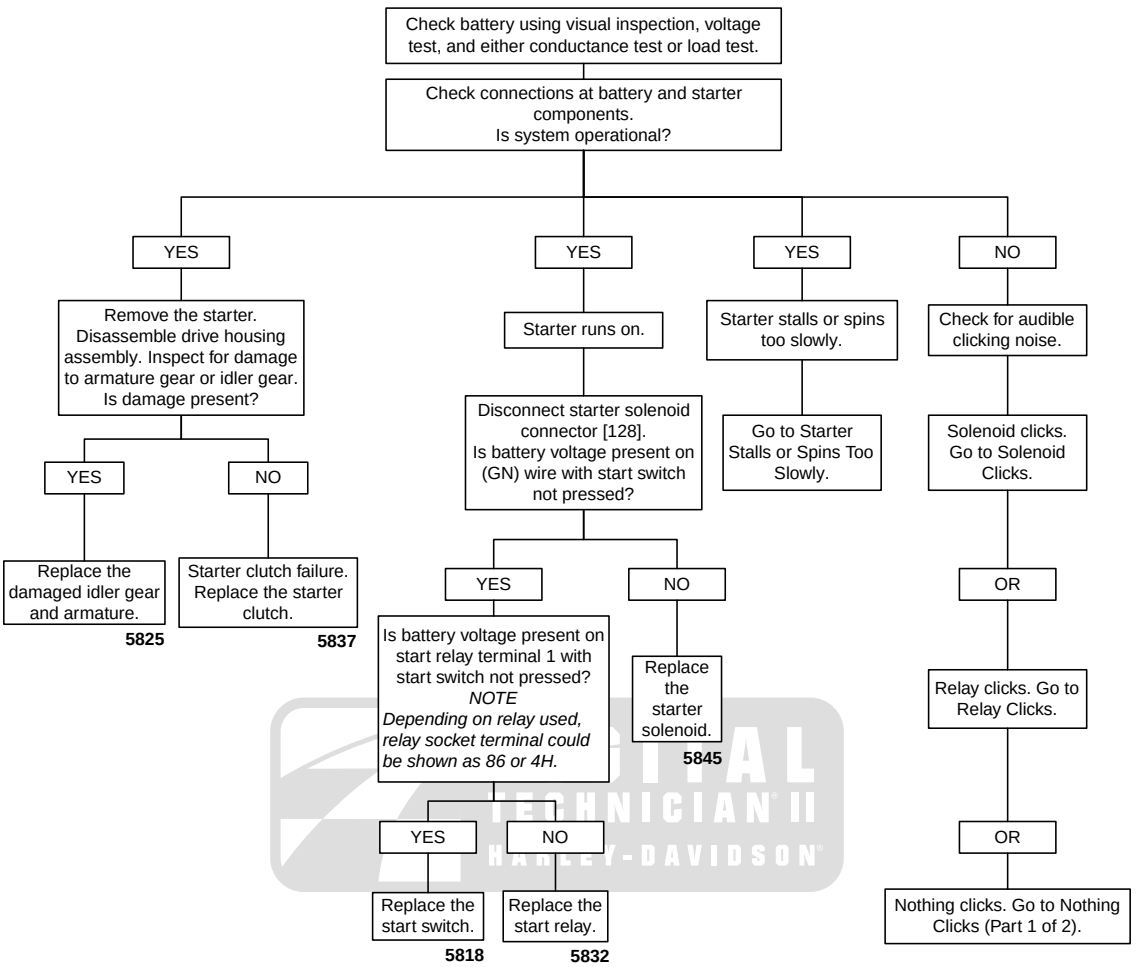
Figure 1-2. Starting Circuit (FLHX, FLHT/C/U, FLTR)

Table 1-4. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[GND1] [GND2]	Left Ground (Dirty)	All	Lug	Under seat
	Right Ground (Clean)	All	Lug	Under seat
[1]	Main to interconnect harness	FLHX, FLHT/C/U	16-place Molex (black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (black)	Inner fairing - right side below radio
[2]	Main to interconnect harness	FLHX, FLHT/C/U. FLTR	12-place Molex (gray)	Inner fairing - left radio support bracket
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[21]	Indicator lamps	FLHX, FLHT/C/U, FLTR	10-place Multilock	Inner fairing - above radio
		FLHR/C	8-place Deustch	Under console
[22]	Right handlebar switches	FLHX, FLHT/C/U, FLTR	12-place Molex (black)	Inner fairing - right fairing support bracket
		FLHR/C	6-place Molex (black)	Inside headlamp nacelle - fork stem nut lock plate (right side)
[24]	Left handlebar switches	FLHX, FLHT/C/U, FLTR	16-place Molex (gray)	Inner fairing - left fairing support brace
		FLHR/C	8-place Molex (gray)	Inside headlamp nacelle - fork stem nut lock plate (left side)
[30]	TSM/TSSM/HFSM	All	12-place Deutsch	Under right side cover
[33]	Ignition switch	FLHX, FLHT/C/U, FLTR	3-place CompX	Bottom of ignition switch
		FLHR/C	3-place Packard	Under console
[78]	ECM	All	73-place Delphi	Under seat
[128]	Starter solenoid	All	Spade terminals	Top of starter
[131]	Neutral switch	All	Post terminals	Top of transmission (right side)
[222]	Console ignition switch interconnect	FLHR/C	4-place Packard	Under seat

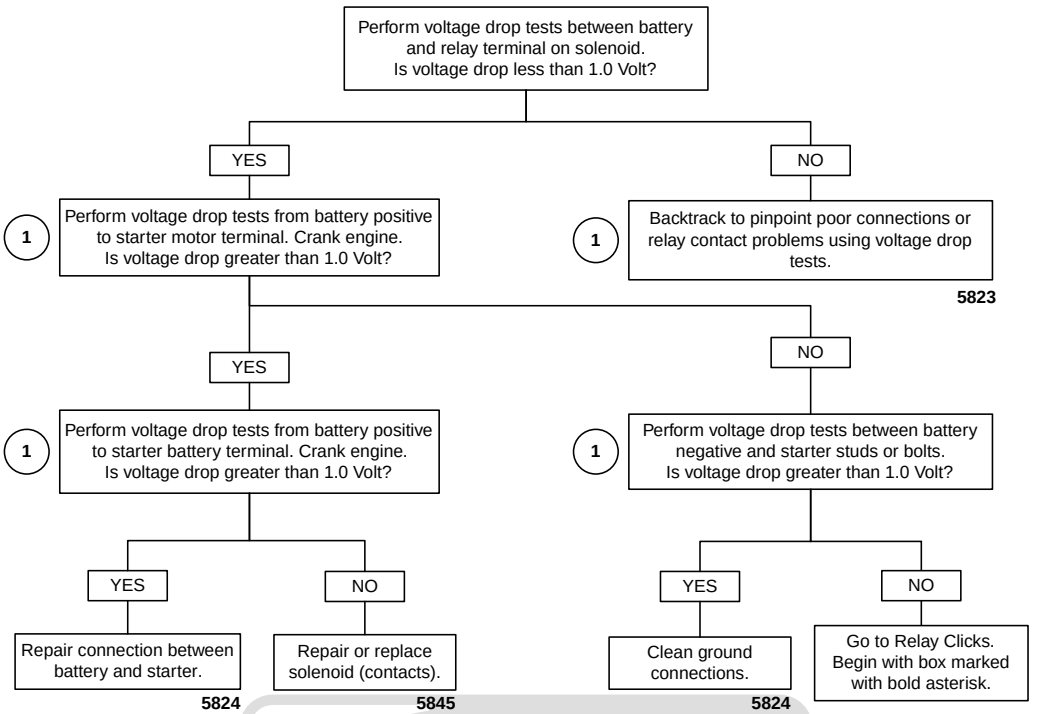
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Initial Starter Test



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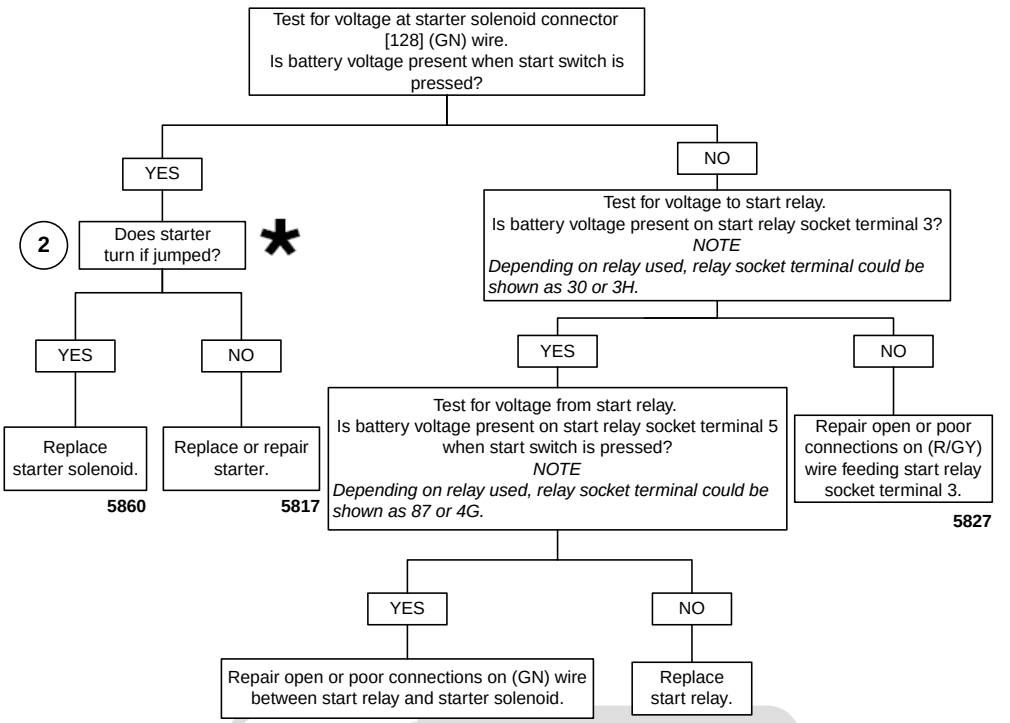
Solenoid Clicks



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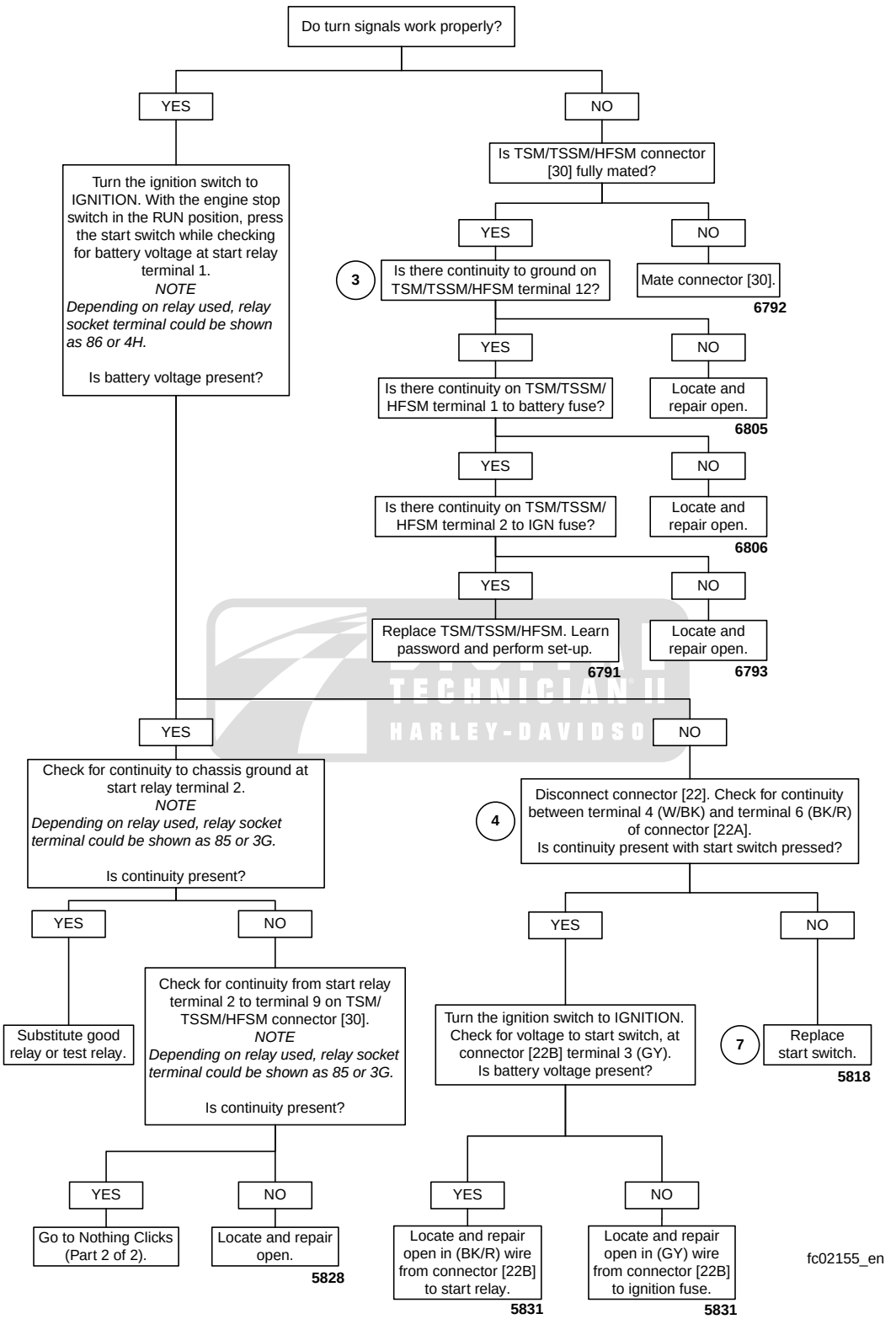
Relay Clicks



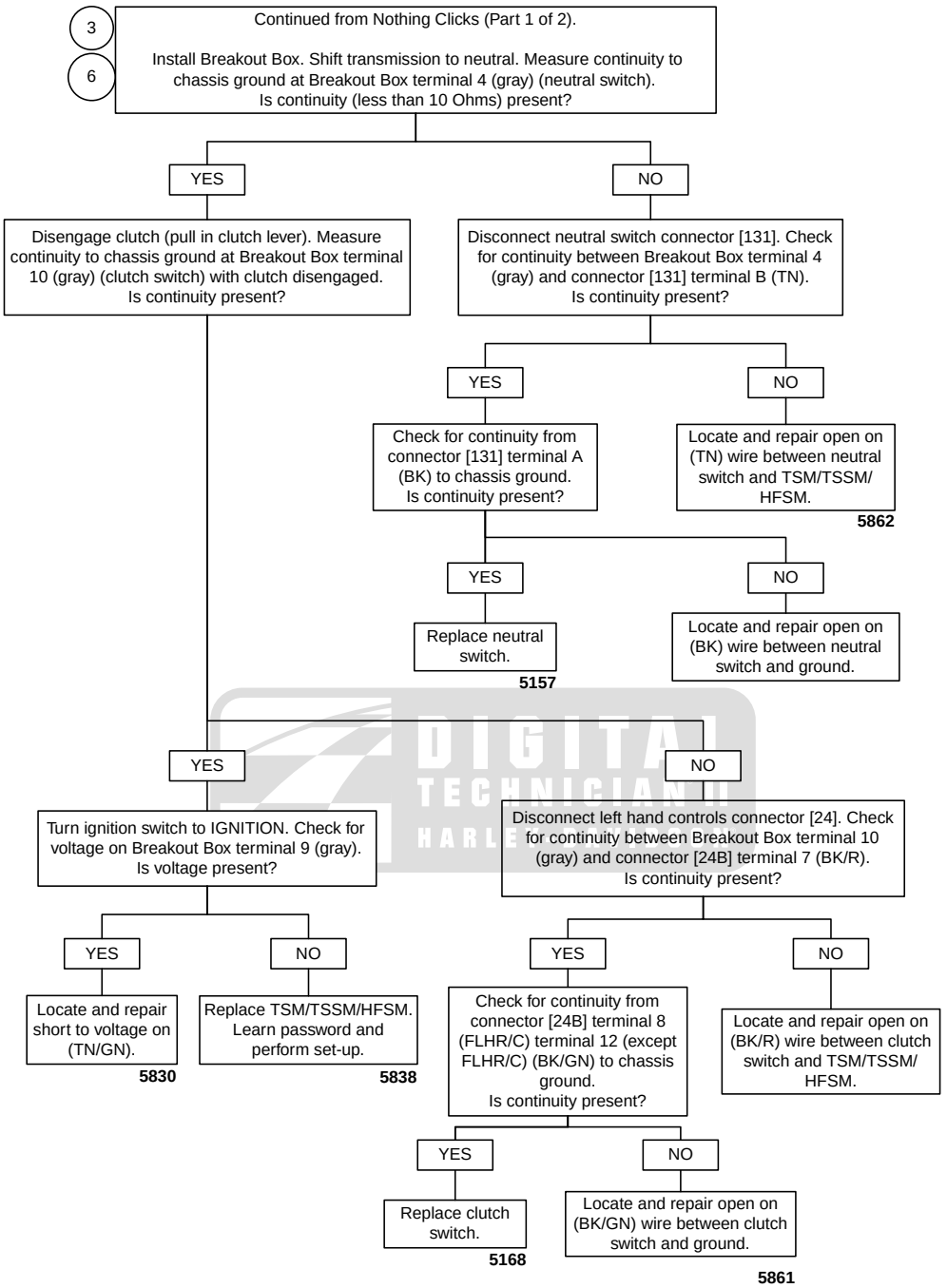
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Nothing Clicks (Part 1 of 2)

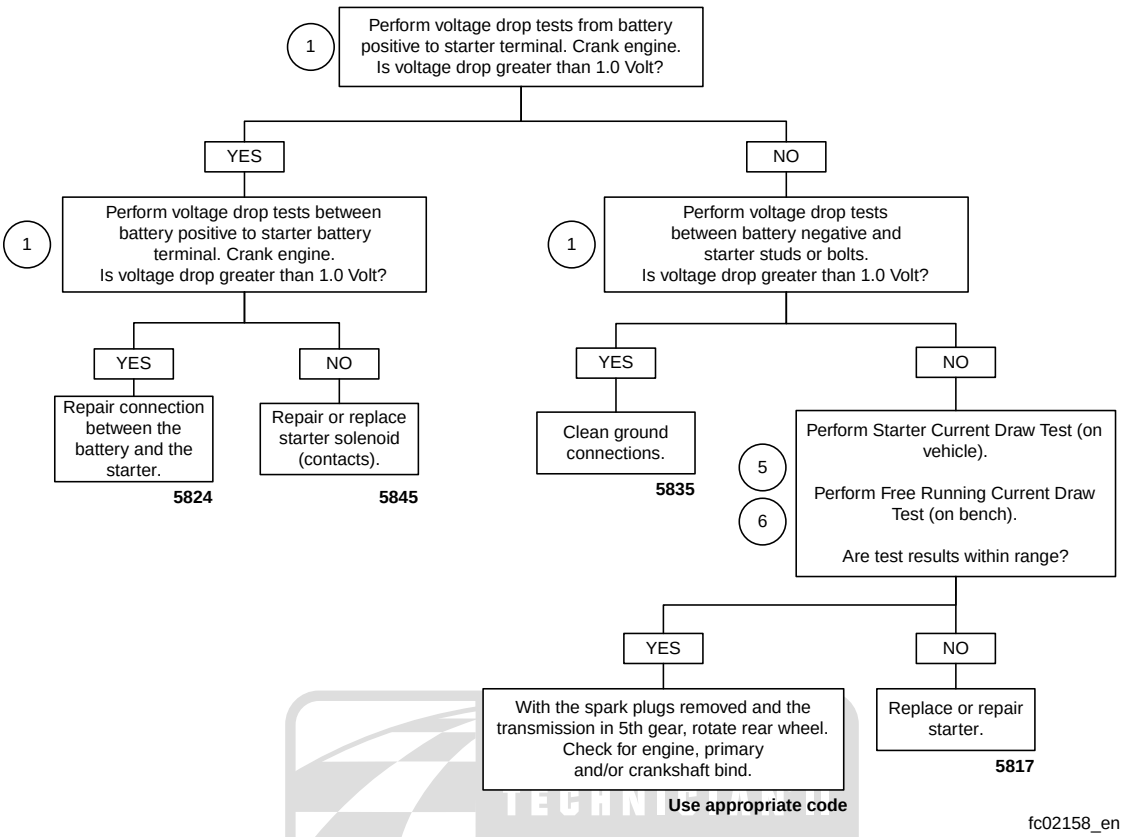


Nothing Clicks (Part 2 of 2)



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Starter Stalls or Spins Too Slowly



DIAGNOSTICS/TROUBLESHOOTING 1.3

VOLTAGE DROP

Check the integrity of all wiring, switches, fuses and connectors between the source and destination.

The voltage drop test measures the difference in potential or the actual voltage dropped between the source and destination.

1. See item A in Figure 1-3. Attach a red meter lead to the most positive part of the circuit. In this case it would be the positive post of the battery (5).
2. See item B in Figure 1-3. Attach the black meter lead to the final destination or component in the circuit (solenoid terminal from relay).
3. Activate the starter and observe the meter reading. The meter reads the voltage dropped or the difference in potential between the source and destination. An ideal voltage drop would be 0 Volt or no voltage dropped, meaning no difference in potential.
4. See item C in Figure 1-3. An open circuit should read 12 Volts, displaying all the voltage dropped, and the entire difference in potential displayed on the meter.

NOTE

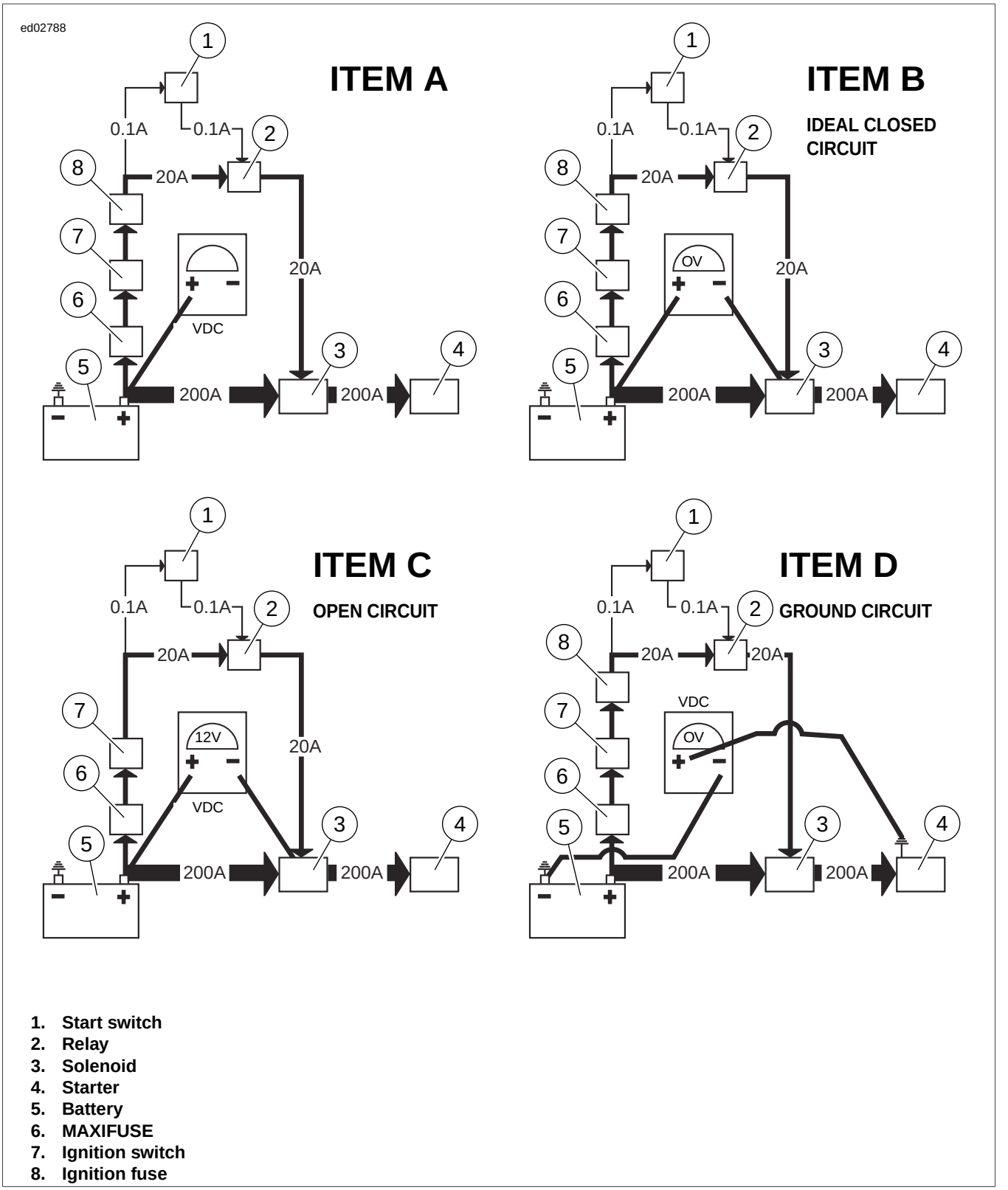
Open circuits on the ground side read zero.

5. Typically, a good circuit drops less than 1.0 Volt. If the voltage drop is greater, backtrack through the connections until the source of the potential difference is found. The benefits of doing it this way are speed and accuracy.
 a. Readings are not as sensitive to real battery voltage.
 b. Readings show the actual voltage dropped, not just the presence of voltage.
 c. This tests the system as it is actually being used. It is more accurate and displays hard to find poor connections.
 d. This approach can be used on lighting circuits and ignition circuits. Start from most positive and go to most negative (the destination or component).
6. See item D in Figure 1-3. The negative or ground circuit can be checked as well.
 a. Place the negative lead on the most negative part of the circuit (or the negative battery post). Remember, there is nothing more negative than the negative post of the battery.
 b. Place the positive lead to the ground you wish to check.
 c. Activate the circuit. This allows you to read the potential difference or voltage dropped on the negative or ground circuit. This technique is very effective for identifying poor grounds due to powdered paint. Even the slightest connection may cause an ohmmeter to give a good reading. However, when sufficient current is passed through, the resistance caused by the powdered paint causes a voltage drop or potential difference in the ground circuit.

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STARTER ACTIVATION CIRCUITS 1.4

STARTER ACTIVATION CIRCUITS



1. Start switch
2. Relay
3. Solenoid
4. Starter
5. Battery
6. MAXIFUSE
7. Ignition switch
8. Ignition fuse

Figure 1-3. Typical Circuitry. Refer to wiring diagrams for more information.

TESTING STARTER ON MOTORCYCLE 1.5

START RELAY TEST

1. See Figure 1-4. Locate the start relay behind the left side cover.
2. See Figure 1-5. Test the start relay using the motorcycle's 12 Volt battery and a digital multimeter.
 a. Unplug connector from relay.
 b. To energize relay, connect relay terminals 85 (2) and 86 (1) to the positive battery terminal.
 c. Check for continuity between the 30 (3) and 87 (5) terminals. A good relay shows continuity (continuity tester lamp on or a zero Ohm reading on the ohmmeter). Replace a malfunctioning relay that does not show continuity.
3. If start relay is functioning properly, proceed to 1.5 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.

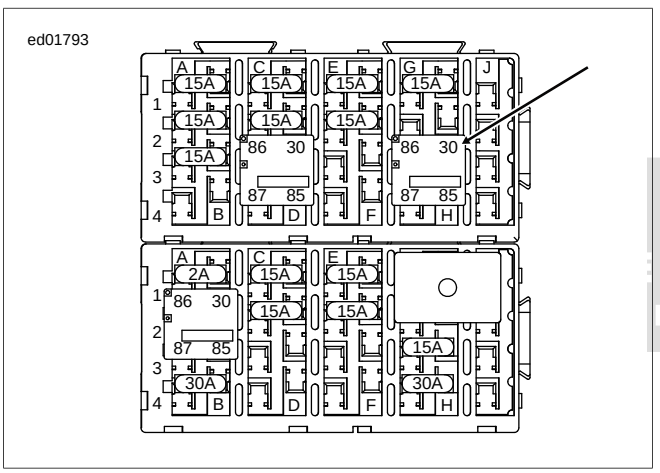
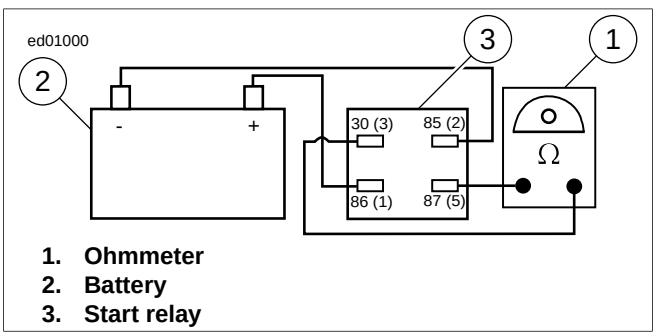


Figure 1-4. Start Relay



1. **Ohmmeter**
2. **Battery**
3. **Start relay**

Figure 1-5. Start Relay Test

STARTER CURRENT DRAW TEST

NOTE

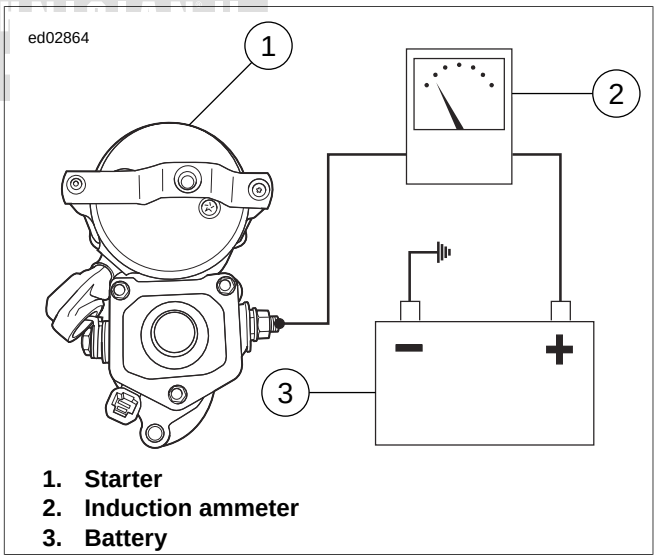
Make sure the engine temperature is stable and at room temperature and the battery is fully charged.

See Figure 1-6. Check starter current draw with an induction ammeter before disconnecting battery. Proceed as follows:

1. Verify the transmission is in neutral. Disconnect spark plug wires from spark plug terminals.
2. Clamp induction ammeter over positive battery cable next to starter.
3. With ignition switch to IGNITION, turn engine over by pressing starter switch while reading the ammeter. Disregard initial high current reading which is normal when engine is first turned over.
 a. Typical starter current draw ranges between 160 to 200 amperes.
 b. If starter current draw exceeds 250 amperes, the problem may be in the starter or starter drive. Remove starter for further tests. See 1.6 TESTING STARTER ON BENCH, Free Running Current Draw Test.

NOTE

A DC current probe may be used if an induction ammeter is not available.



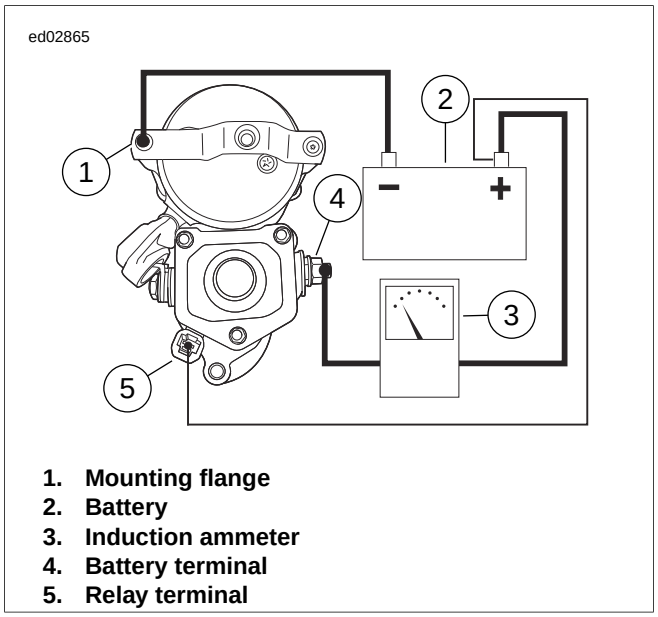
1. **Starter**
2. **Induction ammeter**
3. **Battery**

Figure 1-6. Starter Current Draw Test

TESTING STARTER ON BENCH 1.6

FREE RUNNING CURRENT DRAW TEST

1. Place starter in vise, using a clean shop towel to prevent scratches or other damage.
2. See Figure 1-7. Attach one heavy jumper cable (6 gauge minimum).
 a. Connect one end to the starter mounting flange (1).
 b. Connect the other end to the negative (-) terminal of a fully charged battery (2).
3. Connect a second heavy jumper cable (6 gauge minimum).
 a. Connect one end to the positive (+) terminal of the battery (2).
 b. Connect the other end to the battery terminal (4) on the starter solenoid. Place an induction ammeter (3) over cable.
4. Connect a smaller jumper cable (14 gauge minimum).
 a. Connect one end to the positive (+) terminal of the battery (2).
 b. Connect the other end to the solenoid relay terminal (5).
5. Check ammeter reading.
 a. Ammeter should show 90 Amps maximum.
 b. If reading is higher, disassemble starter for inspection. See the service manual.
 c. If starter current draw on the vehicle was over 200 Amps and this test was within specification, there may be a problem with engine or primary drive.



1. **Mounting flange**
2. **Battery**
3. **Induction ammeter**
4. **Battery terminal**
5. **Relay terminal**

Figure 1-7. Free Running Current Draw Test

STARTER SOLENOID

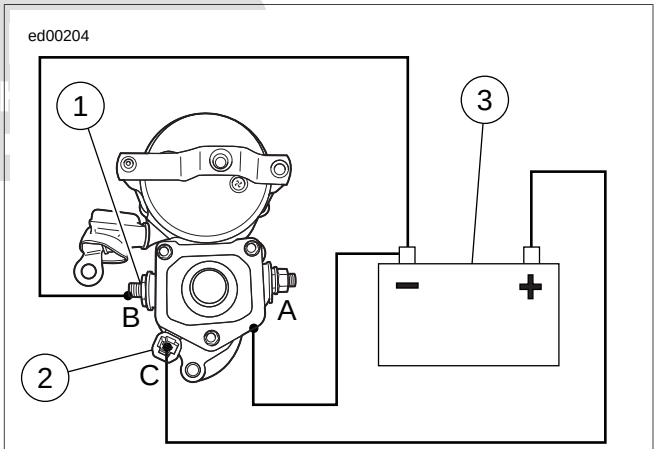
Do not disassemble solenoid. Before testing, disconnect field wire from motor terminal as shown in Figure 1-8.

To prevent damage to the solenoid, perform each test for only three to five seconds.

Perform the solenoid pull-in, hold-in, and return tests together in one continuous operation. Conduct all three tests one after the other in the sequence given without interruption.

SOLENOID PULL-IN TEST

1. See Figure 1-8. Use a 12 Volt battery and connect three separate test leads as follows:
 a. Solenoid housing to negative battery post.
 b. Solenoid motor terminal to negative battery post.
 c. Solenoid relay terminal to positive battery post.
2. Observe starter shaft.
 a. If starter shaft extends strongly, solenoid is working properly.
 b. If starter shaft does not extend strongly, replace the solenoid.



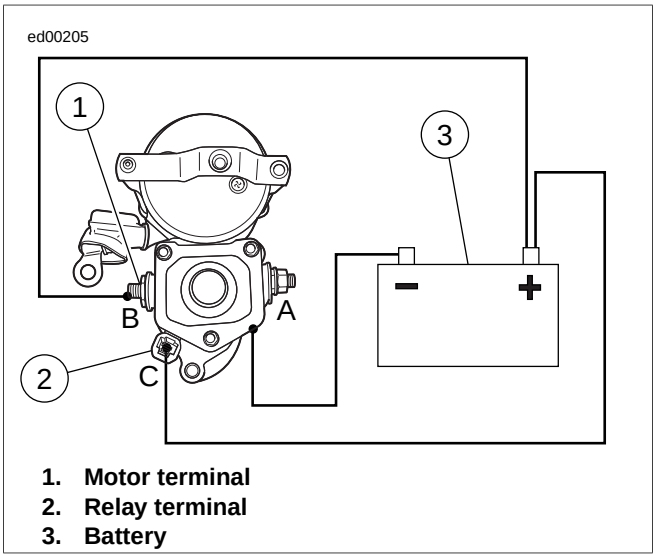
1. **Motor terminal**
2. **Relay terminal**
3. **Battery**

Figure 1-8. Pull-In Test

SOLENOID HOLD-IN TEST

1. See Figure 1-9. With test leads still connected in the manner specified in 1.6 TESTING STARTER ON BENCH, Solenoid Pull-In Test, disconnect solenoid motor terminal/battery negative test lead at negative battery post only; reconnect loose end of this test lead to positive battery post.

2. Observe starter shaft.
 a. If starter shaft remains extended, solenoid is working properly.
 b. If starter shaft retracts, replace the solenoid.

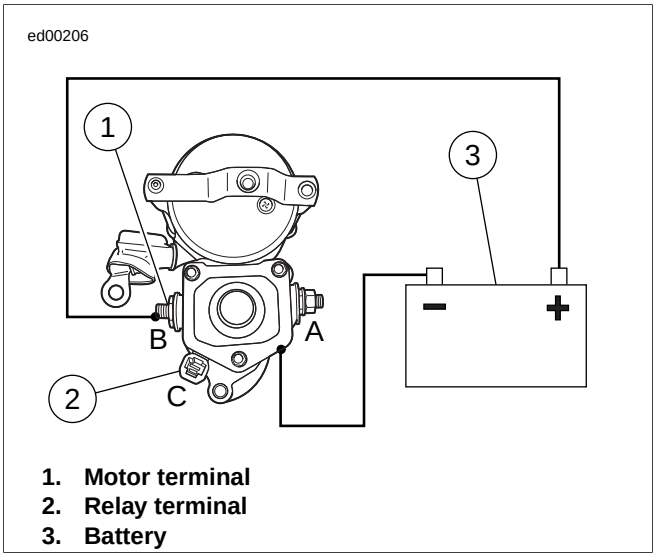


1. **Motor terminal**
2. **Relay terminal**
3. **Battery**

Figure 1-9. Hold-In Test

SOLENOID RETURN TEST

1. See Figure 1-10. With test leads still connected in the manner specified at the end of 1.6 TESTING STARTER ON BENCH, Solenoid Hold-In Test, disconnect solenoid relay terminal/positive battery post test lead at either end.
2. Observe starter pinion.
 a. If starter shaft retracts, solenoid is working properly.
 b. If starter shaft does not retract, replace the solenoid.



1. **Motor terminal**
2. **Relay terminal**
3. **Battery**

Figure 1-10. Return Test

TESTING

Armature

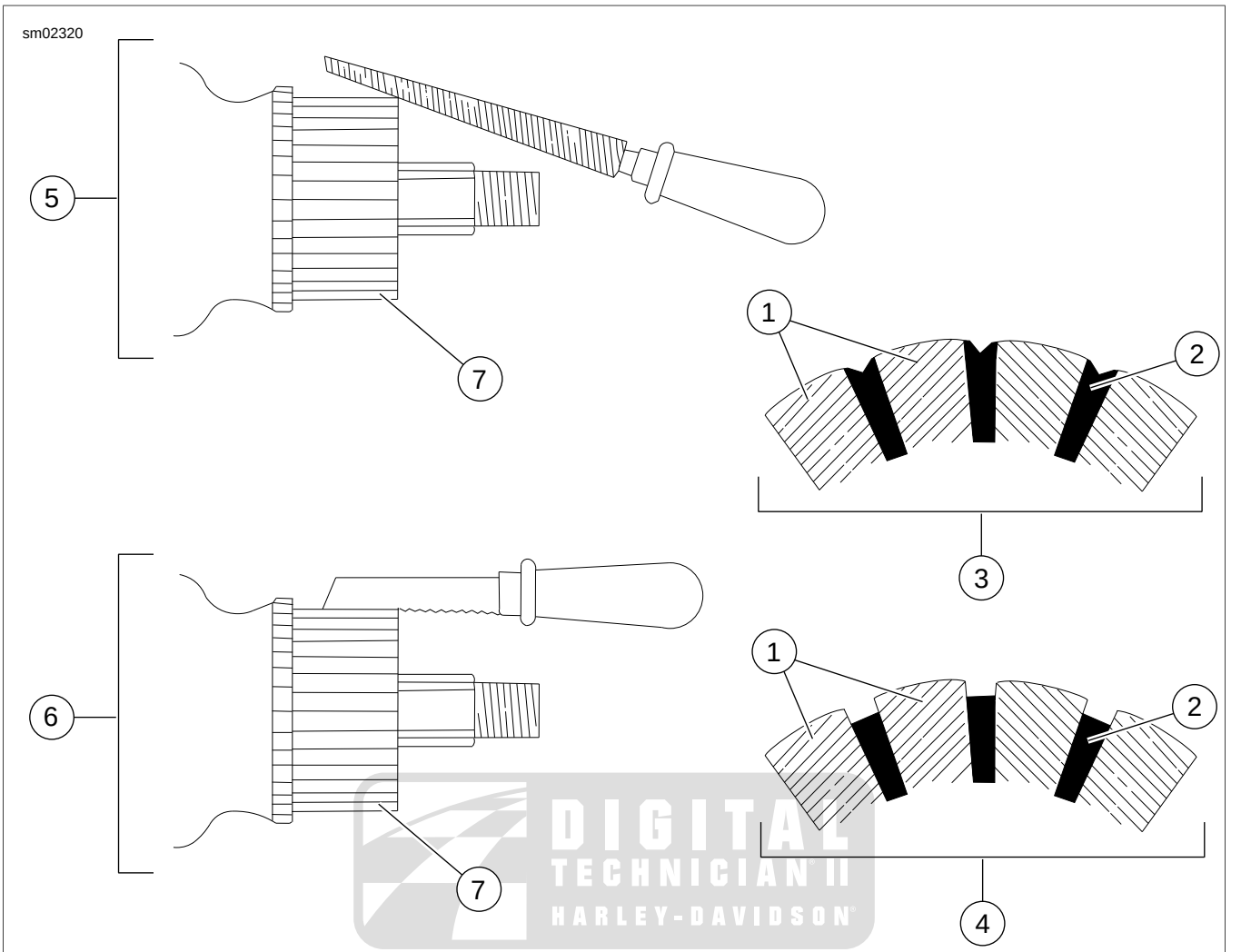
1. Remove armature and brush holder from field coil. See the service manual.
2. Place armature in lathe or truing stand and check runout of commutator. Commutators with more than 0.015 in. (0.38 mm) of runout should be replaced or machined on a lathe. Commutators should be replaced when diameter is less than 1.141 in. (29.98 mm).
3. Check depth of mica on commutator. If undercut is less than 0.008 in. (0.20 mm), use an undercutting machine to undercut the mica to 0.0312 in. (0.79 mm) deep. Clean the slots to remove any dirt or copper dust.

NOTES

- *See Figure 1-11. If an undercutting machine is not available, undercutting can be done satisfactorily using a thin hacksaw blade. After undercutting, lightly sand the armature with crocus cloth to remove any burrs.*
- *Do not use sandpaper or emery cloth on commutator. The abrasive grit may remain on commutator segments and could cause excessive brush wear.*

4. See Figure 1-12. Check for a shorted armature.
 a. Place armature on growler (1).
 b. Hold a thin steel strip (2) (hacksaw blade), against the armature core and slowly turn armature.
 c. A shorted armature causes the steel strip to vibrate and be attracted to the core. Replace the armature if shorted.
5. See Figure 1-13. Check for a grounded armature with an ohmmeter or continuity tester.
 a. Touch one probe to any commutator segment.
 b. Touch the other probe to the armature core.
 c. There should be no continuity (infinite Ohms). If there is continuity, the armature is grounded. Replace a grounded armature.
6. See Figure 1-14. Check for an open armature with an ohmmeter or continuity tester.
 a. Check for continuity between all commutator segments.
 b. There should be continuity (0 Ohms) at all test points. If there is no continuity at any test point, then the armature is open. Replace an open armature.

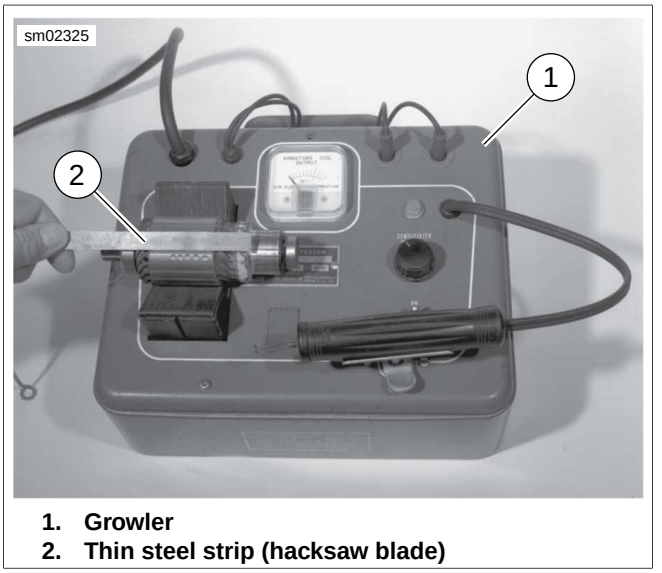
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1. **Segments**
2. **Mica**
3. **Incorrect (Mica must not be left with a thin edge next to segments)**
4. **Correct (Mica must be cut away clean between segments)**
5. **Starting groove in mica with 3 cornered file**
6. **Undercutting mica with piece of hacksaw blade**
7. **Commutator**

Figure 1-11. Undercutting Mica Separators

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1. **Growler**
2. **Thin steel strip (hacksaw blade)**

Figure 1-12. Shorted Armature Test Using Growler

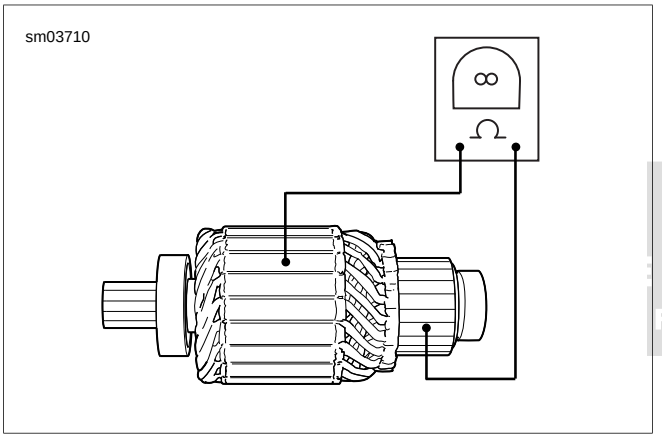


Figure 1-13. Grounded Armature Test

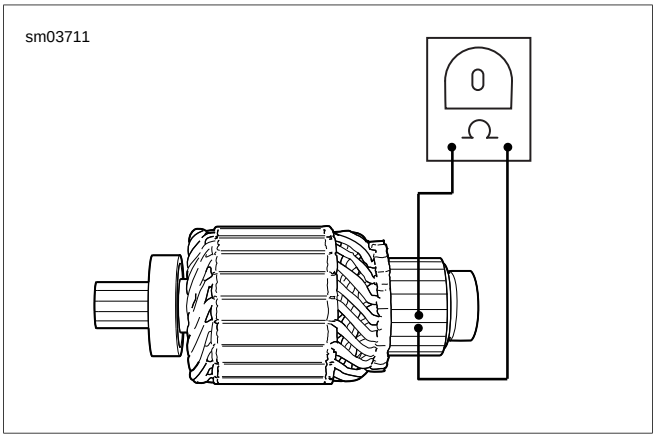


Figure 1-14. Open Armature Test

Brushes and Brush Holder

1. Remove armature and brush holder from field coil. See the service manual.
2. Measure the brush length. If any one of four brushes is less than 0.433 in. (11 mm), replace the field coil and brush holder assembly. No further testing is necessary.
3. See Figure 1-15. Check for a grounded field coil winding with an ohmmeter or continuity tester.
 a. Touch one probe to the field coil housing (frame).
 b. Touch the other probe to each of two brushes attached to the field coil winding.
 c. There should be no continuity (infinite Ohms). If there is continuity at either brush, then the field coil winding is grounded. Replace the field coil/brush holder assembly if grounded.
4. See Figure 1-16. Check for an open field coil winding with an ohmmeter or continuity tester.
 a. Touch one probe to the field wire.
 b. Touch the other probe to each of the two brushes attached to the field coil winding(s).
 c. There should be continuity (0 Ohms). If there is no continuity at either brush, then the field coil winding(s) are open. Replace the field coil/brush holder assembly if open.
5. See Figure 1-17. Test the brush holder insulation with an ohmmeter or continuity tester.
 a. Touch one probe to the holder plate.
 b. Touch the other probe to each of the positive (insulated) brush holders.
 c. There should be no continuity (infinite Ohms). If there is continuity at either brush holder, replace the field coil/brush holder assembly.
 d. Touch one probe to the non-insulated brush holders and the other probe to the holder plate. If any resistance is measured, replace the field coil/brush holder assembly.

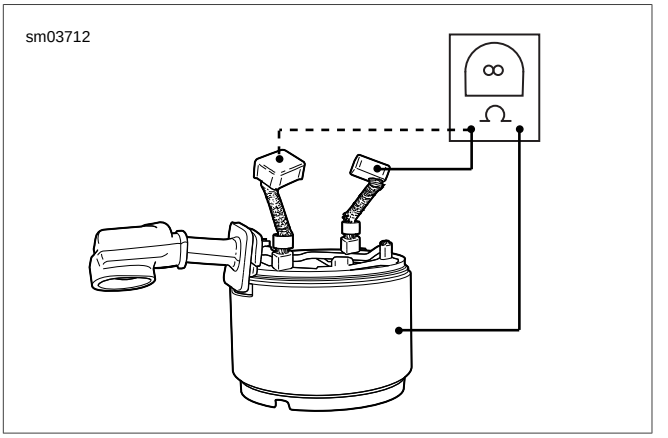


Figure 1-15. Grounded Field Coil Test

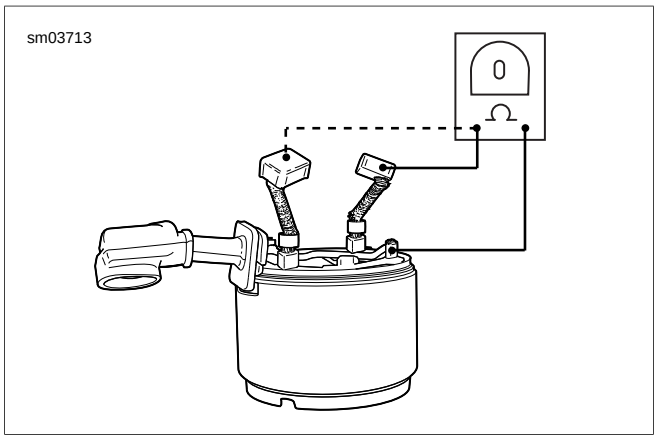
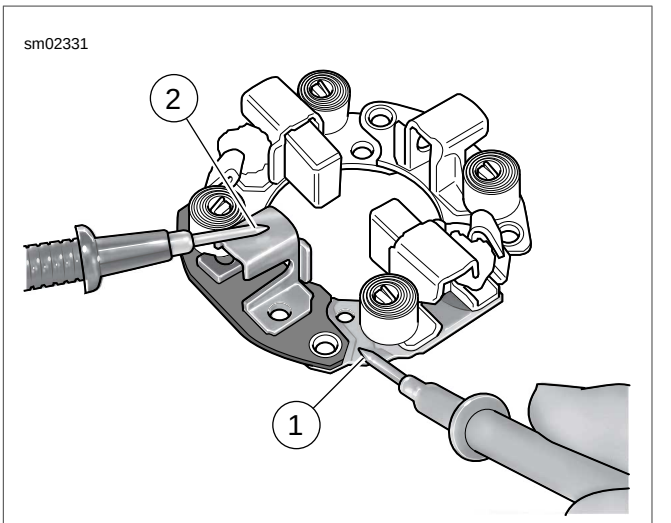


Figure 1-16. Open Field Coil Test



1. **Holder plate**
2. **Positive (insulated) brush holder**

Figure 1-17. Brush Holder Insulation Test

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CHARGING SYSTEM 1.7

GENERAL

The charging system consists of the alternator and voltage regulator. Charging system circuits are shown in Figure 1-19.

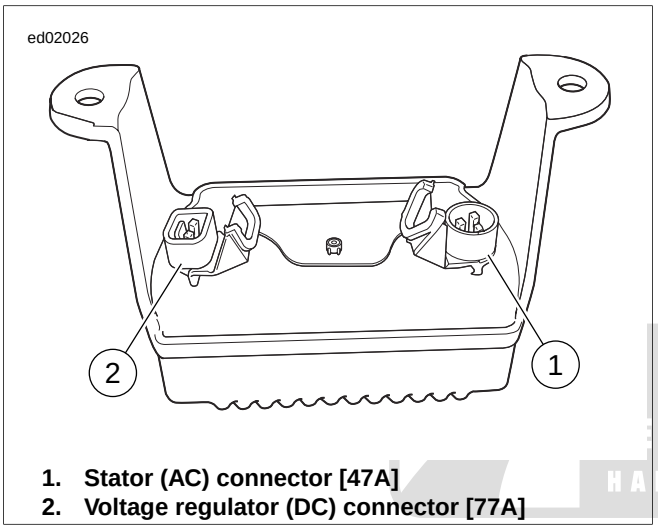
Alternator

The alternator consists of two main components:

- The rotor which mounts to the engine sprocket shaft.
- The stator which bolts to the engine crankcase.

Voltage Regulator

See Figure 1-18. The voltage regulator is a series regulator. The circuit combines the functions of rectifying and regulating.



1. **Stator (AC) connector [47A]**
2. **Voltage regulator (DC) connector [77A]**

Figure 1-18. Voltage Regulator (Bottom View) AC and DC Connectors

TROUBLESHOOTING

PART NUMBER	TOOL NAME
HD-48053	ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER

When the charging system fails to charge or does not charge at a satisfactory rate, make the following recommended checks.

Battery

Check for a weak or dead battery. See 1.8 BATTERY TESTING for battery testing procedures. Battery must be fully charged in order to perform a load test, or starting or charging tests. However, a partially discharged battery may be tested using the BATTERY TEST function of the ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER (Part No. HD-48053).

Wiring

The stator and battery plug and socket connections must be clean and tight.

See Figure 1-19. Check for corroded or loose connections in the charging circuit.

Voltage Regulator Inspection

The voltage regulator must have a clean, tight connection for proper operation. Check by using an ohmmeter with one lead on chassis ground, such as battery ground cable, and the other on the voltage regulator ground lead.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

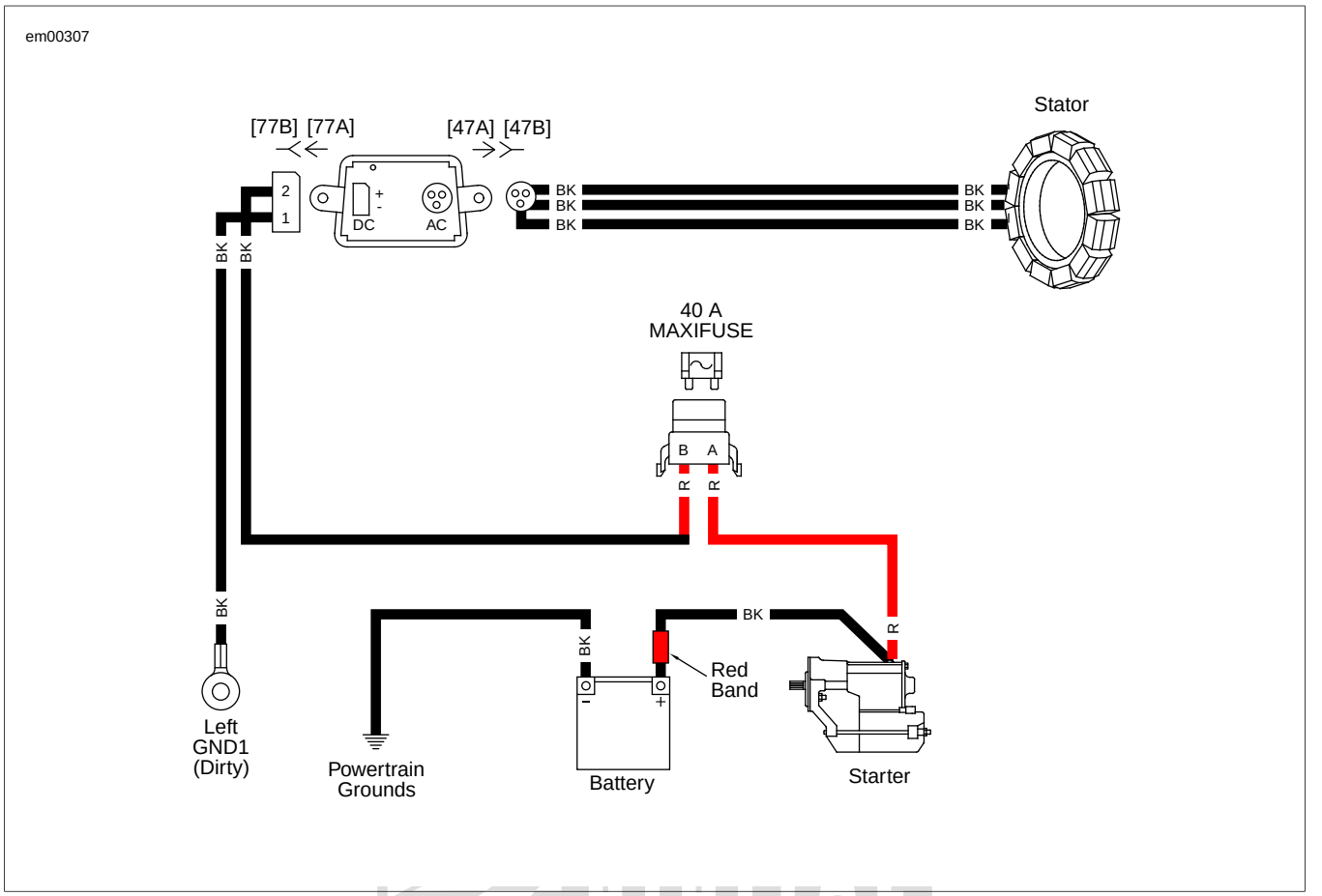
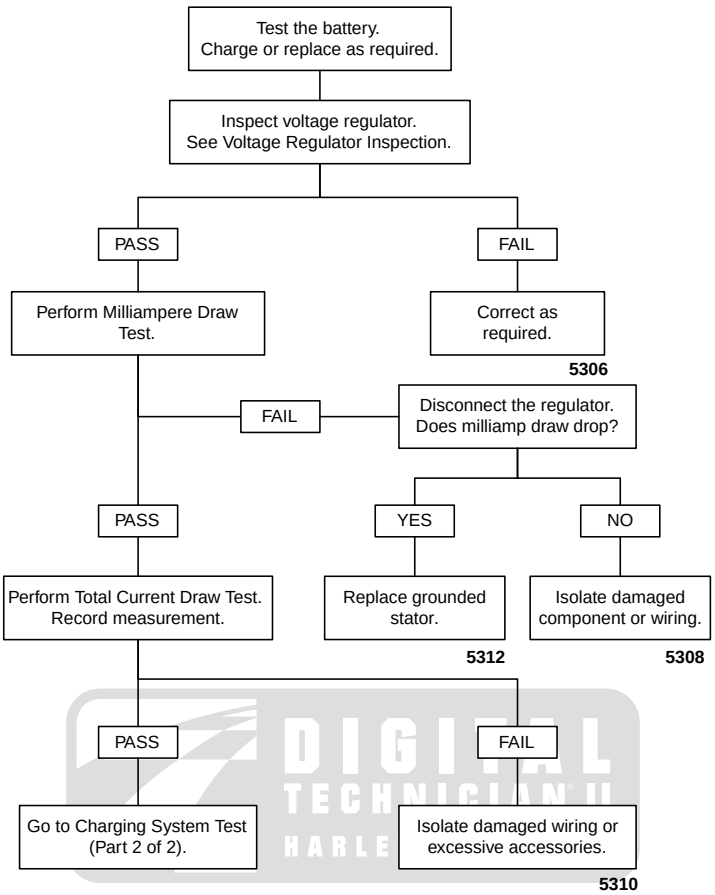


Figure 1-19. Charging System Circuit (Typical)

Table 1-5. Wire Harness Connectors

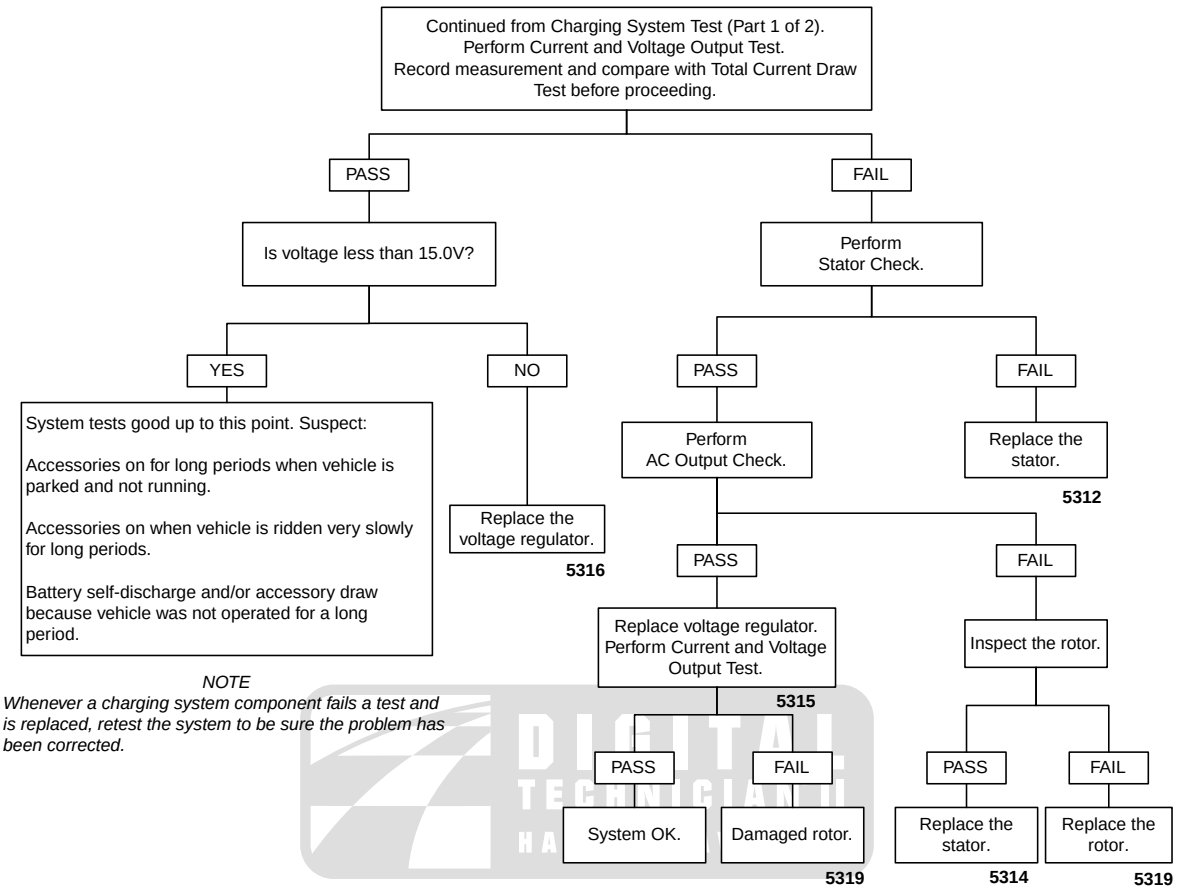
NO.	DESCRIPTION	TYPE	LOCATION
[5]	MAXIFUSE	2-place Packard	Under left side cover
[47]	Stator	3-place Lyall	Bottom of voltage regulator (left side)
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)
[GND1]	Harness ground	Ring terminals	Under seat

Charging System Test (Part 1 of 2)



fc02159_en

Charging System Test (Part 2 of 2)



NOTE
Whenever a charging system component fails a test and is replaced, retest the system to be sure the problem has been corrected.

fc02160_en

TESTING

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48053	ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER

Milliampere Draw Test

NOTES

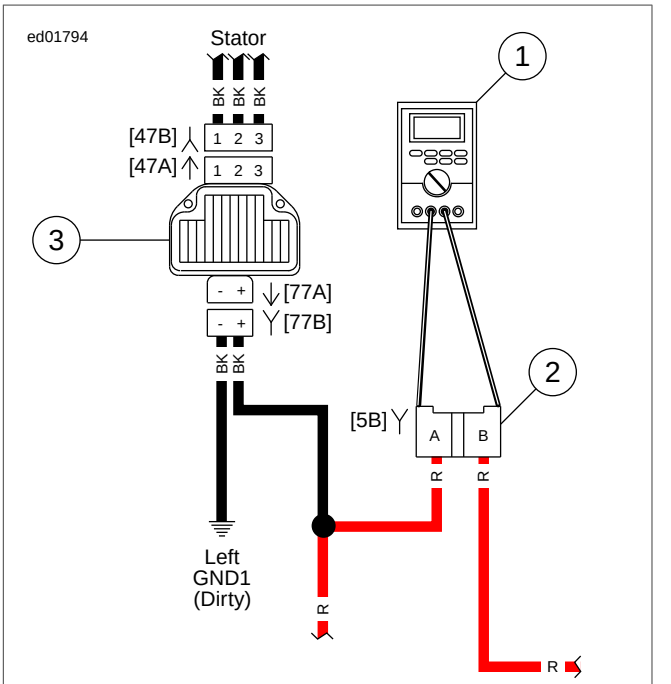
- *Be sure accessories are not wired so they stay on at all times. This condition could drain battery completely if vehicle is parked for a long time. Check for this by connecting ammeter between negative battery terminal and battery.*
- *TSM/TSSM/HFSM continues to draw 16-25 mA for 30 seconds after ignition is turned off. Any disruption and reconnection of battery power, such as disconnecting the battery to place a meter in series, causes TSM/TSSM/HFSM to draw 16-25 mA for 30 seconds.*

Disconnect siren during milliamperes draw test (siren may draw up to 20 mA).

1. Remove left side cover. Remove MAXIFUSE.
2. See Figure 1-20. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) red male socket probes and patch cords, connect ammeter to MAXIFUSE socket terminals. With this arrangement, regulator drain is also picked up.
3. With ignition switch turned to OFF and all lights and accessories off, observe current reading.
 a. Refer to Table 1-6. Add regulator draw ammeter reading to appropriate value for TSM/TSSM/HFSM/ECM. If observed ammeter reading is less than listed in table, draw is within limits.
 b. A higher reading indicates excessive current draw. Check all accessories for excessive drain.

NOTE

A battery with a surface discharge condition could suffer a static drain. Correct by cleaning battery case.



1. **Ammeter**
2. **MAXIFUSE socket**
3. **Voltage regulator**

Figure 1-20. Milliampere Draw Test (Ignition Turned to OFF)

Table 1-6. Milliampere Draw Test

ITEM	MAXIMUM DRAW IN MILLIAMPERES
ECM	1.0
Speedometer	1.0
Tachometer	1.0
TSM (no security)	1.0
TSSM (armed)	3.0
TSSM (disarmed)	3.0
TSSM (storage mode)	1.0
HFSM	1.0
Security siren (optional)	20.0*
Voltage regulator	2.0
Radio	2.0
High output amplifier	1.0
CB module	1.0
XM module	1.0
* Siren draws for 2-24 hours from the time the motorcycle battery is connected and 0.05 milliamperes once siren battery is charged. Disconnect siren during milliampere draw test.	

Total Current Draw Test

If battery runs down during use, the current draw of the motorcycle components and accessories may exceed output of the charging system.

NOTE

If a load tester is unavailable, an ammeter with current probe may be used.

⚠WARNING

Turn battery load tester OFF before connecting tester cables to battery terminals. Connecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00252a)

1. See Figure 1-21. To check for this condition, place load tester induction pickup or current probe pickup over battery negative cable.
2. Disconnect stator plug from voltage regulator. Start the motorcycle and run the engine at 2000 RPM.
3. With ignition and all continuously running lights and accessories turned on (headlamp on high beam), read the total current draw.
4. Compare this reading to the reading obtained after performing the Current and Voltage Output Test.
 a. The current output should exceed current draw by 3.5 Amps minimum.
 b. If output does not meet specifications, there may be too many accessories for the charging system to handle.
5. Reconnect voltage regulator after testing.

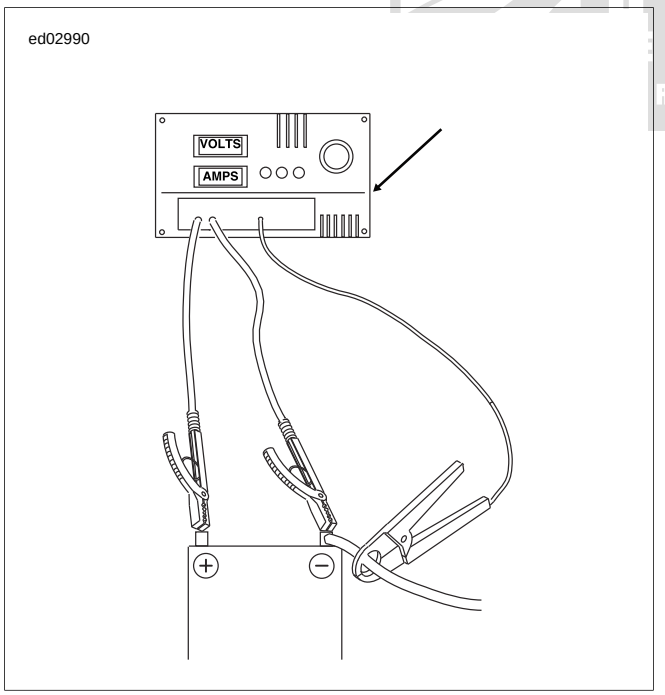


Figure 1-21. Check Current Draw (Ignition Switch On)

Current and Voltage Output Test: Using HD-48053

1. Connect the ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER (Part No. HD-48053) leads to the vehicle's battery.
2. Follow the instructions in the analyzer's instruction manual to perform a Charging System Test.

 See Figure 1-22. The test results include a decision on the charging system's condition and the measured system voltage at idle and at 3000 RPM. The analyzer's printer provides a printout including one of two possible test results:

- CHARGING SYSTEM NORMAL - No problem found.
- CHARGING SYSTEM PROBLEM - The analyzer detected a problem and displays one of the three following results:

1. LOW CHARGING VOLTS - The alternator is not supplying sufficient current for the system's electrical loads.
2. HIGH CHARGING VOLTS - The voltage output from the alternator exceeds the normal regulator limits.
3. INVESTIGATE VOLT OUTPUT - The rev voltage is lower than the idle voltage.

Current and Voltage Output Test: Using Load Tester

1. See Figure 1-21. Connect load tester.
 a. Connect negative and positive leads to battery terminals.
 b. Place load tester induction pickup over positive regulator cable.
2. Run the engine at 3000 RPM. Increase the load as required to obtain a constant 13.0 VDC. Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible.
3. The current output should be 35-50 Amps. Note the measurement for use in Total Current Draw Test.

NOTE

Rider's habits may require output test at lower RPM.

4. See Figure 1-21. After removing the load, read the load tester voltage meter.
 a. If voltage to the battery is not more than 15 Volts, voltage output is within specifications. Investigate other possible problems. See Charging System Test.
 b. If voltage is higher, voltage regulator is not functioning properly.

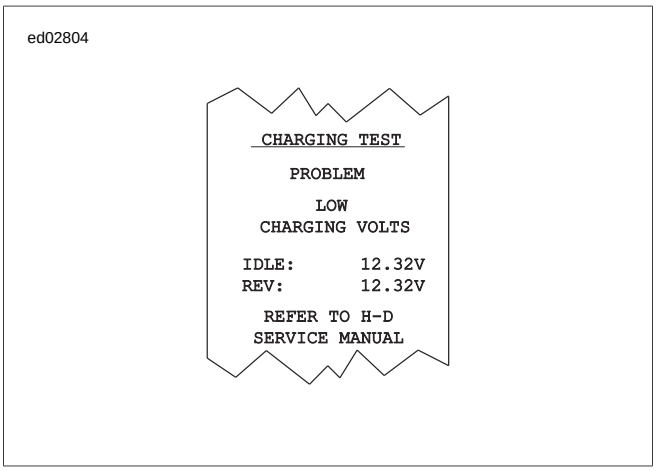


Figure 1-22. Charging System Test Results Printout

Stator Check

1. Turn ignition switch to OFF.
2. See Figure 1-23. Connect an ohmmeter.
 a. Disconnect voltage regulator connector from alternator stator wiring.
 b. Insert one ohmmeter lead into a stator connector socket.
 c. Attach the other lead to a suitable ground.
3. Test for continuity with ohmmeter set to the ohms scale.
 a. A good stator shows no continuity (open circuit) between any stator sockets and ground.
 b. Any other reading indicates a grounded stator which must be replaced.
4. See Figure 1-24. Remove ground lead. Check resistance across stator sockets 1-2, 2-3 and 3-1.
5. Test for resistance with ohmmeter set on the ohms scale.
 a. Resistance across all the stator sockets should be 0.1-0.2 Ohm.
 b. If the resistance is higher, the stator is damaged and must be replaced.
 c. If the resistance is lower, it could indicate turn to turn short.

NOTE

Verify the meter reads 0 Ohm when probes are shorted together. If not, subtract lowest value to resistance value of stator.

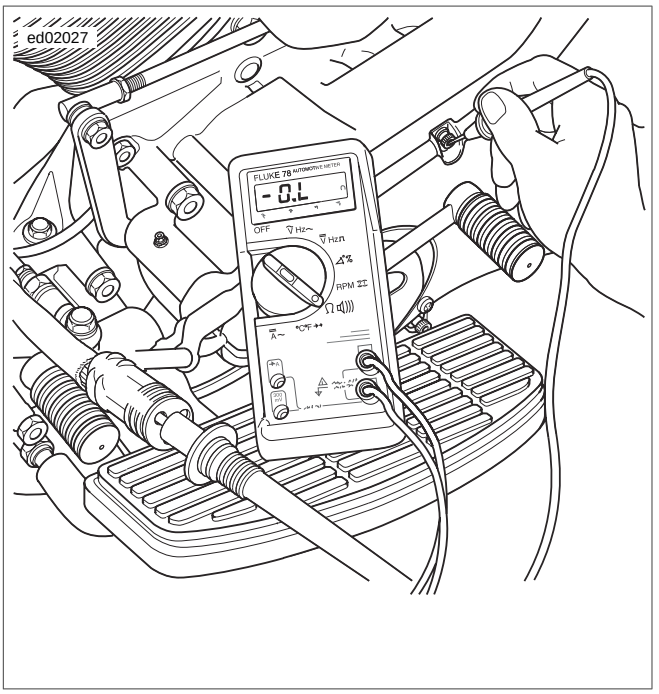


Figure 1-23. Test for Grounded Stator (Typical)

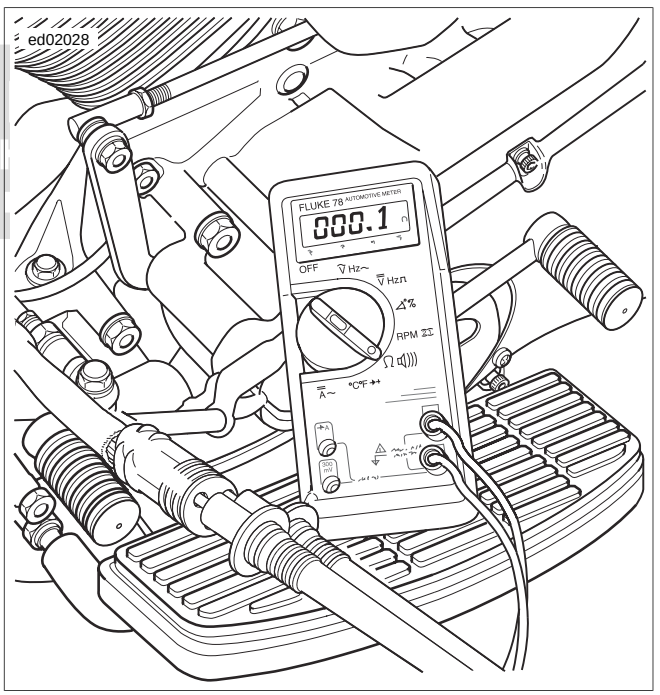


Figure 1-24. Check for Stator Resistance (Typical)

AC Output Check

1. See Figure 1-25. Test AC output.
 a. Disconnect voltage regulator connector from alternator stator wiring.
 b. Connect an AC voltmeter across stator connector sockets 1-2.
 c. Run the engine at 2000 RPM. The AC output should be 32-46 Volts AC (approximately 16-23 per 1000 RPM).
 d. Repeat test across stator sockets 2-3 and 3-1.
2. Compare test results to specifications.
 a. If the output is below specifications, charging problem could be a faulty rotor or stator.
 b. If output is within specifications, charging problem might be faulty regulator. Replace as required.
3. Check the output again as previously described under Current and Voltage Output Test.

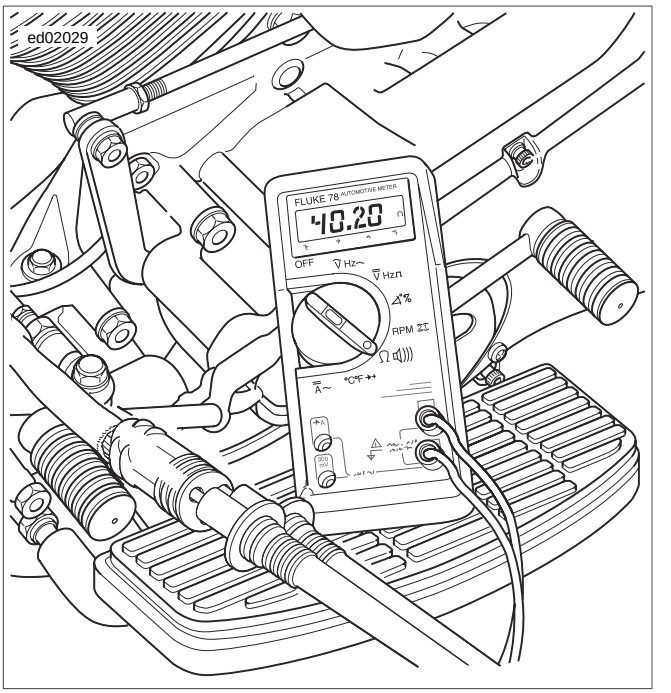


Figure 1-25. Check Stator AC Voltage Output (Typical)

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BATTERY TESTING 1.8

GENERAL

Three different procedures may be performed to provide a good indicator of battery condition; a voltage test, a conductance test, or a load test.

A battery may be tested, whether fully charged or not, via conductance test. In order to perform a load test, the battery must be fully charged.

VOLTMETER TEST

The voltmeter test provides a general indicator of battery state of charge or condition. Check the voltage of the battery to verify that it is in a 100% fully charged condition. Refer to Table 1-7.

If the open circuit (disconnected) voltage reading is below 12.6 Volts, charge the battery and then recheck the voltage after the battery has set for one to two hours. If the voltage reading is 12.7 Volts or above, perform the load test described in this section.

Table 1-7. Voltmeter Test For Battery Charge Conditions

VOLTAGE	STATE OF CHARGE
12.7	100%
12.6	75%
12.3	50%
12.0	25%
11.8	0%

CONDUCTANCE TEST

PART NUMBER	TOOL NAME
HD-48053	ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER

Test the battery using the ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER (Part No. HD-48053). Perform a battery test as follows:

1. Connect the HD-48053 analyzer leads to the vehicle battery lead terminal, not to bolt or wire terminal.

NOTE

Connect the tester directly to the lead terminals of the battery, and not the bolts.

2. Follow the instructions in the analyzer instruction manual to perform a battery test.

The test results include a decision on the battery condition and the measured state of charge.

See Figure 1-26. The analyzer printer provides you with a printout including one of six possible test results:

- GOOD BATTERY - Return the battery to service.
- GOOD-RECHARGE - Fully charge the battery and return to service.
- CHARGE & RETEST - Fully charge the battery and retest.
- REPLACE BATTERY - Replace the battery.
- BAD CELL-REPLACE - Replace the battery and retest.
- BATTERY NOISE - Remove surface charge from battery and retest.

NOTES

- *A REPLACE BATTERY test result may also mean a poor connection between the battery cables and the vehicle. After disconnecting the battery cables from the battery, retest the battery using the out-of-vehicle test before replacing.*
- *Connect the tester directly to the lead terminals of the battery, and not the bolts.*

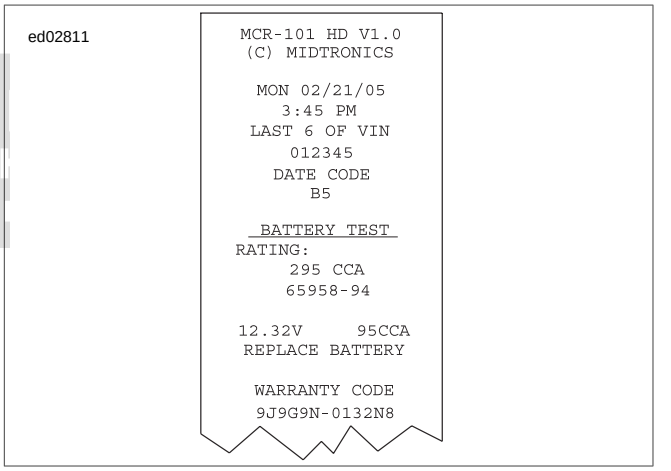


Figure 1-26. Battery Test Results Printout

LOAD TEST

To load test the battery, proceed as follows:

⚠WARNING

Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)

1. Remove the battery from the motorcycle.
2. Always fully charge the battery before testing or test readings will be incorrect. Load testing a discharged battery can also result in permanent battery damage.
3. After charging, allow battery to stand for at least one hour before testing.

⚠WARNING

Turn battery load tester OFF before connecting tester cables to battery terminals. Connecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00252a)

4. See Figure 1-27. Connect tester leads to battery posts and place induction pickup over negative (black) cable.

NOTE

To avoid load tester and/or battery damage, do not leave the load tester switch turned on for more than 20 seconds.

5. Refer to Table 1-8. Using a load tester load battery at 50% of CCA rating. Voltage reading after 15 seconds should be 9.6 Volts or more at 70 °F (21 °C).

⚠WARNING

Turn battery load tester OFF before disconnecting tester cables to battery terminals. Disconnecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00253a)

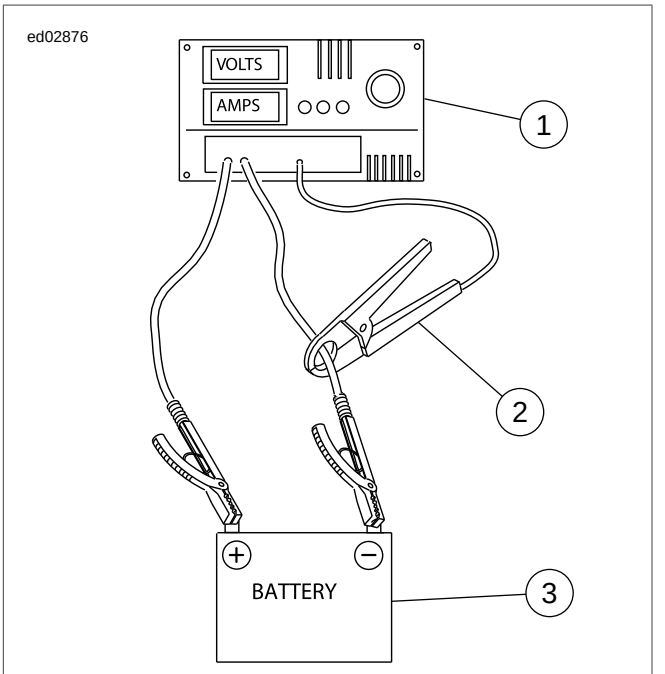
⚠WARNING

Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

CAUTION

Do not over-tighten bolts on battery terminals. Use recommended torque values. Over-tightening battery terminal bolts could result in damage to battery terminals. (00216a)

6. Install the battery in the motorcycle.



1. **Load tester**
2. **Induction pickup**
3. **Battery**

Figure 1-27. Load Test Battery

Table 1-8. Battery Load Test

COLD CRANKING AMPERAGE (CCA)	100%	50%
Touring models	300	150

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2.4 SPEEDOMETER/TACHOMETER	2-13
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NOTES

CHECKING FOR DIAGNOSTIC TROUBLE CODES 2.1

CHECK ENGINE LAMP

See Figure 2-1. To diagnose ECM system problems, begin by observing the behavior of the check engine lamp.

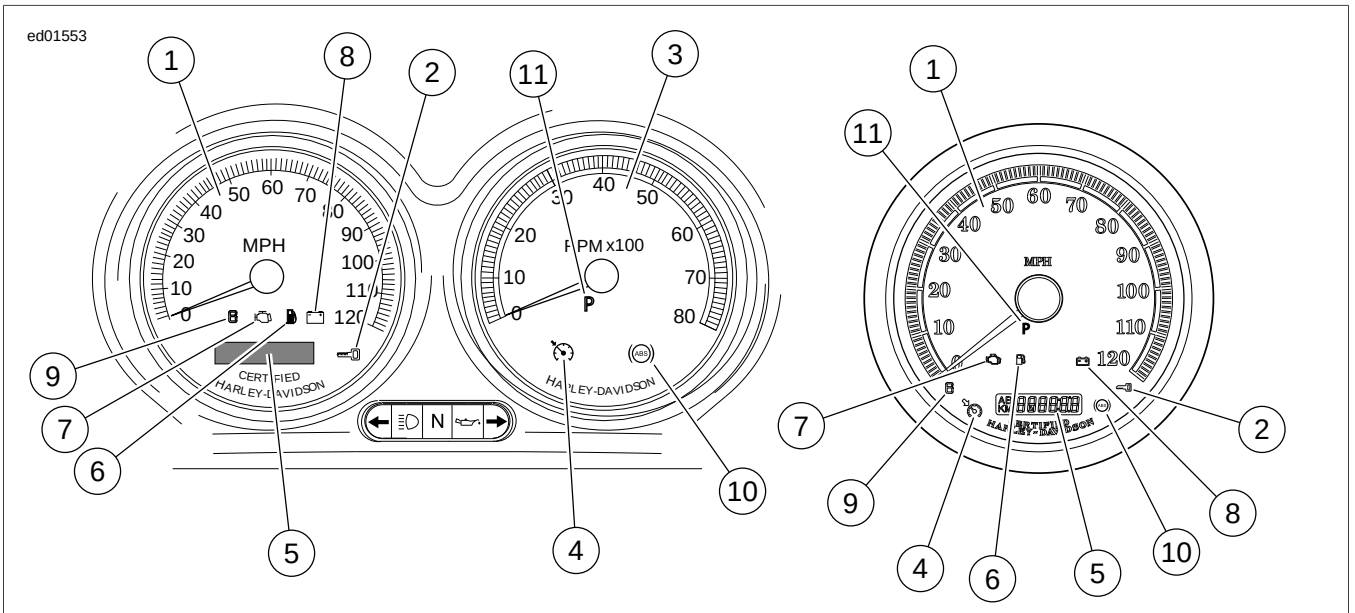
NOTES

- *See Figure 2-2. Key ON means the ignition switch is turned to IGNITION and the engine stop switch is set to RUN (although the engine is **not** running).*
- *When the ignition switch is turned to IGNITION, the check engine lamp illuminates for approximately four seconds and then turns off.*
- *If the check engine lamp is not illuminated at ignition on, the problem is likely to be an instrument failure. See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.*
- *If the check engine lamp illuminates late (after 20 seconds), the problem is most likely a serial data bus failure. Test for DTCs using speedometer self-diagnostics. See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.*
- *If the check engine lamp fails to turn off after the initial four-second period, see 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.*

1. See Figure 2-3. After the check engine lamp turns off following the first four-second illumination period, one of three events may occur:
 a. The lamp remains off. This indicates there are no current fault conditions or stored DTCs currently detected by the ECM.
 b. The lamp remains off for only four seconds and then illuminates for an eight-second period. This indicates a DTC is stored, but no current DTC exists.
 c. The lamp remains on beyond the eight-second period. This indicates a current DTC exists.
2. See 2.1 CHECKING FOR DIAGNOSTIC TROUBLE CODES, Code Types which follows for a complete description of DTC formats.

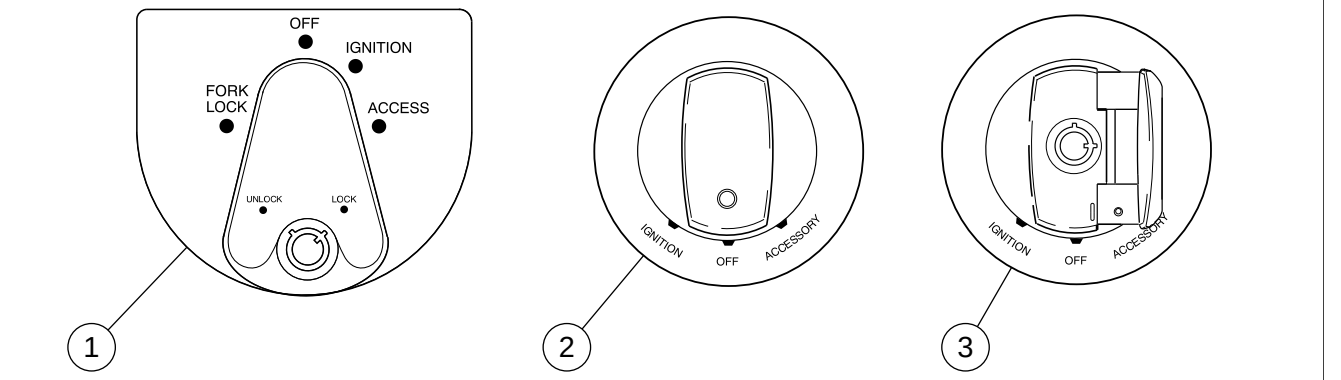
NOTE

Some DTCs can only be fully diagnosed during actuation. For example, a problem with the ignition coil is considered a current fault even after the problem is corrected, since the ECM will not know of its resolution until after the coil is exercised by the vehicle start sequence. In this manner, there may sometimes be a false indication of the current DTC.



1. **Speedometer**
2. **Security lamp (key icon)**
3. **Tachometer**
4. **Cruise lamp**
5. **Odometer/trip odometer/clock**
6. **Low fuel warning lamp**
7. **Check engine lamp**
8. **Battery discharge lamp**
9. **Sixth gear lamp**
10. **ABS lamp**
11. **Pursuit lamp**

Figure 2-1. Speedometer



1. **All except FLHR models**
2. **All FLHR models (cover shown closed)**
3. **All FLHR models (cover shown open)**

Figure 2-2. Ignition Switch (FLHX, FLHT/C/U, FLTR)

SECURITY LAMP

To diagnose TSM/HFSM system problems, begin by observing the behavior of the security lamp.

NOTES

- *To provide an indication of HFSM DTCs, the security lamp is enabled on HFSM models.*
- *See Figure 2-2. Key ON means the ignition switch is turned to IGNITION and the engine stop switch is set to RUN (although the engine is **not** running).*
- *When the ignition switch is turned to IGNITION, the check engine lamp illuminates for approximately four seconds and then turns off.*
- *If the check engine lamp is not illuminated at ignition on, the problem is likely to be an instrument failure. See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.*
- *If the check engine lamp illuminates late (after 20 seconds), see 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.*
- *If the security lamp fails to turn OFF after the initial four-second period, a problem exists in the instrumentation. See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.*

1. See Figure 2-3. After the security lamp turns off following the first four-second illumination period, one of three events may occur:
 a. The lamp remains off. This indicates there are no current fault conditions or stored DTCs currently detected by the HFSM.
 b. The lamp stays off for only four seconds and then comes back on for an eight-second period. This indicates a DTC is stored, but no current DTC exists.
 c. The lamp remains on beyond the eight-second period. This indicates a current DTC exists.
2. See 2.1 CHECKING FOR DIAGNOSTIC TROUBLE CODES, Code Types which follows for a complete description of DTC formats.

NOTE

Some DTCs can only be fully diagnosed during actuation. For example, a problem with the turn signals is considered a current fault even after the problem is corrected, since the TSM/HFSM will not know of its resolution until after the turn signals are activated. In this manner, there may sometimes be a false indication of the current DTC.

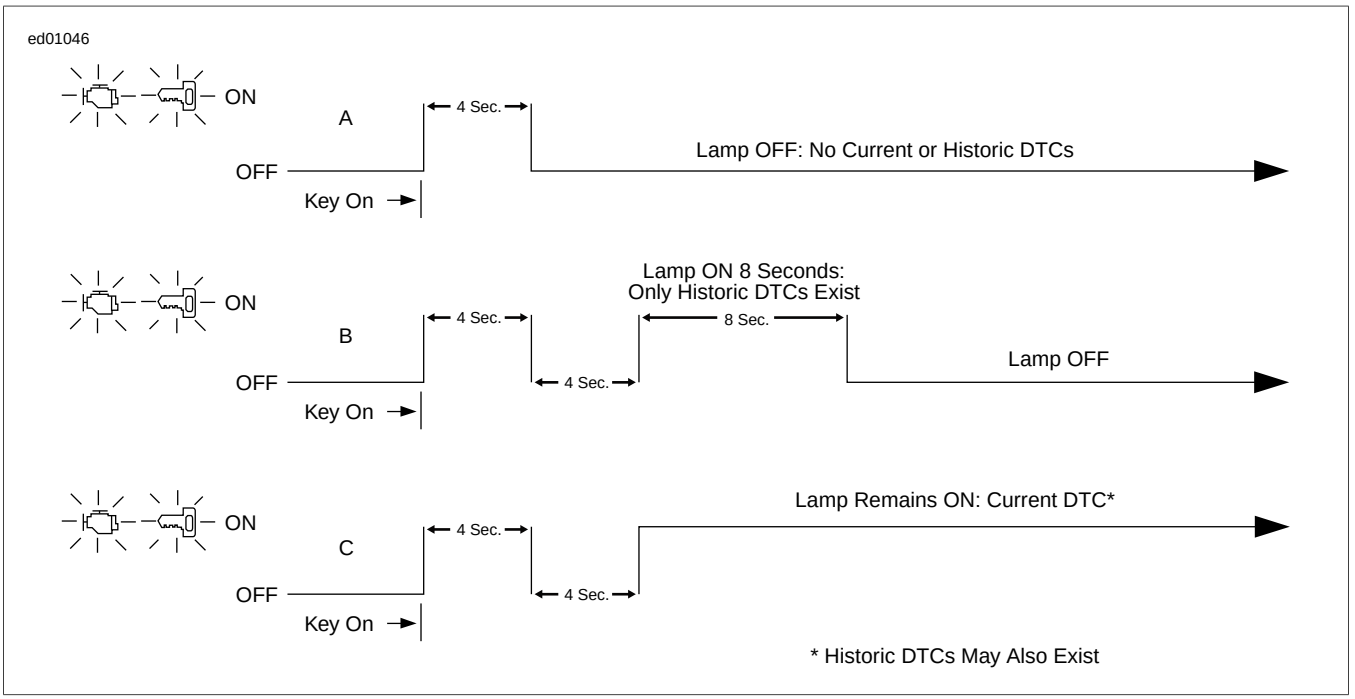


Figure 2-3. Check Engine and Security Lamp Operation

CODE TYPES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

There are two types of DTCs: current and historic. If a DTC is stored, it can be read using DIGITAL TECHNICIAN II (Part No. HD-48650) or speedometer self-diagnostics. See 2.3 SPEEDOMETER SELF-DIAGNOSTICS.

All DTCs reside in the memory of the ECM, TSM/TSSM/HFSM, speedometer or tachometer until the code is cleared.

Current

Current DTCs are those which presently disrupt motorcycle operation. See the appropriate flowcharts for solutions.

Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic rather than current fault. Historic DTCs are stored for a length of time to assist in the diagnosis of intermittent faults.

Historic DTCs are cleared after a total of 50 trips has elapsed. A trip consists of a start and run cycle. After the 50 trip retention period, the historic DTC is automatically erased from memory providing no subsequent faults of the same type are detected in that period.

DTCs can only be identified as historic using DIGITAL TECHNICIAN II (Part No. HD-48650), a computer-based diagnostic package.

It is important to note that historic DTCs may also be present whenever the system indicates the existence of a current fault. See 2.1 CHECKING FOR DIAGNOSTIC TROUBLE CODES, Multiple Diagnostic Trouble Codes if multiple DTCs are found.

Diagnostic charts are designed for use with current DTCs and as a result they frequently suggest wire repair or part replacement.

RETRIEVING DIAGNOSTIC TROUBLE CODES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The engine management system provides two levels of diagnostics.

- The most sophisticated mode employs DIGITAL TECHNICIAN II (Part No. HD-48650), a computer-based diagnostic package.
- The second mode requires using the speedometer self-diagnostics. See 2.3 SPEEDOMETER SELF-DIAGNOSTICS.

MULTIPLE DIAGNOSTIC TROUBLE CODES

While it is possible for more than one fault to occur and set more than one DTC, there are several conditions which may result in one fault setting multiple DTCs. For example, serial data DTCs (DTC U1016, U1064, U1097, U1300 and U1301) may be accompanied by other DTCs. Always correct the serial data DTCs before resolving other DTCs.

Refer to Table 2-2 for proper resolution of multiple DTCs.

INITIAL DIAGNOSTIC CHECK: SPEEDOMETER 2.2

GENERAL

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

Constant power is supplied to the speedometer through terminal 5 of connector [39]. The speedometer turns on when power is applied to terminal 1. The speedometer proceeds through an initialization sequence every time power is removed and reapplied to terminal 6. The visible part of this sequence is the check engine lamp (in run mode), security lamp, backlighting, odometer and fuel level. Upon ignition on, the check engine lamp and security lamp illuminate for four seconds and then (if parameters are normal) go out.

To locate faulty circuits or other system problems, follow the diagnostic flowcharts and tests in this section. For a systematic approach, always begin with 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER, Initial Diagnostics which follows. Read the general information and then work your way through the flowchart box by box.

Loss of power on any of the four power inputs changes speedometer behavior. Refer to Table 2-1.

Table 2-1. Speedometer Function Chart - Loss of Input

Terminal 5 (Constant)	Terminal 1 (IGN)	Terminal 6 (ACC)	Terminal 7 (GRD)	Terminal 8 and 11 (Trip Odometer Reset Switch)
Security lamp glows dimly during 4-second bulb check.	Will not "WOW".	Display will be non-functional in accessory and ignition modes.	Display completely non-functional.	No trip odometer reset switch function.
	Turn signals still functional.	Security lamp still performs 4-second bulb check in ignition mode.	Diagnostic absent.	Will not "WOW".
	Speedometer indicates vehicle speed (zero).			
	Security lamp still functions.			
	Check engine lamp and battery lamp non-functional.			
	Diagnostics absent.			

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Diagnostic Notes

If a numbered circle appears adjacent to a flowchart box, more information is offered in the diagnostic notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual where information on the location and removal of components may be obtained.

Circuit Diagram/Wire Harness Connector Table

When working through a flowchart, refer to the illustrations, the associated circuit diagram and the wire harness connector table as necessary. The wire harness connector table for each circuit diagram identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a BREAKOUT BOX (Part No. HD-42682) and a DVOM are required. See 2.5 BREAKOUT BOX: SPEEDOMETER/TACHOMETER.

To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

INITIAL DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Tips

- If speedometer reads BUS Er with the ignition switch turned to IGNITION (engine stop switch at RUN with the engine off), check data bus for an open or short to ground between DLC [91A] terminal 3 and ECM connector [78B] terminal 69, TSM/TSSM/HFSM connector [30B] terminal 3, speedometer connector [39B] terminal 2 or tachometer (if equipped) connector [108B] terminal 2.
- Check for an open data test terminal between DLC [91A] terminal 3 and TSM/TSSM/HFSM connector [30B] terminal 3. With ignition switch turned to IGNITION, serial data bus

voltage should be 0.6-0.8 Volt. The range of acceptable voltage is greater than 0 and less than 7.0 Volts.

- To identify intermittents, wiggle instrument and/or vehicle harness while performing steps in the Diagnostic Check charts.

Diagnostic Notes

The reference number below correlates with the circled number on the initial diagnostic check flowcharts.

1. Connect BREAKOUT BOX (Part No. HD-42682) and INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) between wire harness and speedometer.

All speedometer DTCs are listed in Table 2-2.

Table 2-2. Speedometer/Tachometer Diagnostic Trouble Codes (DTC) Priority Chart

DTC	PRI-ORITY	FAULT CONDITION	SOLUTION	MODULE
BUS Er	1	Serial data bus shorted low/open/high	2.14 DTC U1300, U1301 OR BUS ER	Speedometer/tachometer
U1300	2	Serial data low	2.14 DTC U1300, U1301 OR BUS ER	Speedometer/tachometer
U1301	3	Serial data high	2.14 DTC U1300, U1301 OR BUS ER	Speedometer/tachometer
U1016	4	Loss of ECM serial data	2.12 DTC U1016	Speedometer/tachometer
U1064	5	Loss of TSM/TSSM/HFSM serial data.	2.13 DTC U1064, U1255	Speedometer/tachometer
U1255	6	Missing response from other module (TSM/TSSM/HFSM and/or ECM) at startup	2.13 DTC U1064, U1255	Speedometer/tachometer
B1007	7	Ignition line overvoltage	2.10 DTC B1006, B1007	Speedometer/tachometer
B1006	8	Accessory line overvoltage	2.10 DTC B1006, B1007	Speedometer/tachometer
B1008	9	Reset switch closed	2.11 DTC B1008	Speedometer
B1004	10	Fuel level sending unit low	2.9 DTC B1004, B1005	Speedometer
B1005	11	Fuel level sending unit high/open	2.9 DTC B1004, B1005	Speedometer

Other Diagnostic Trouble Codes

See 3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM for any DTCs related to the TSM, TSSM or HFSM.

See 4.5 INITIAL DIAGNOSTIC CHECK: EFI for any DTCs related to the ECM.

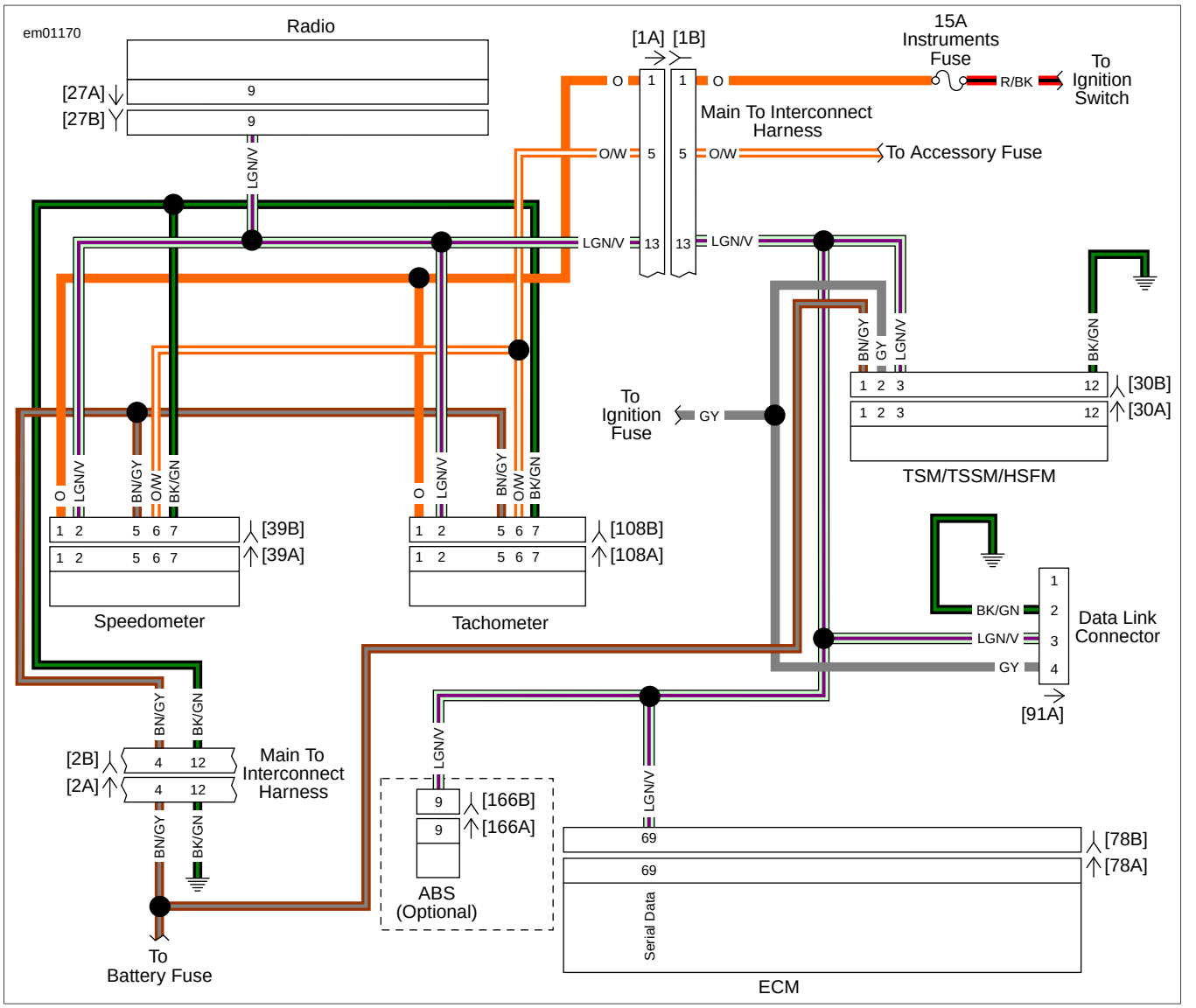


Figure 2-4. Diagnostic Check: FLHX, FLHT/C/U, FLTR

Table 2-3. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHX, FLHT/C/U	16-place Molex (black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (black)	Inner fairing - right side below radio
[2]	Main to interconnect harness	All	12-place Molex (gray)	Inner fairing - left radio support bracket
[27]	Radio	All	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[30]	TSM/TSSM/HFSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHX, FLHT/C/U	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
[78]	ECM	All	73-place Packard	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover

Table 2-3. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[108]	Tachometer	FLHX, FLHT/C/U	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)
[166]	ABS module	All	20-place Molex	Under right side cover

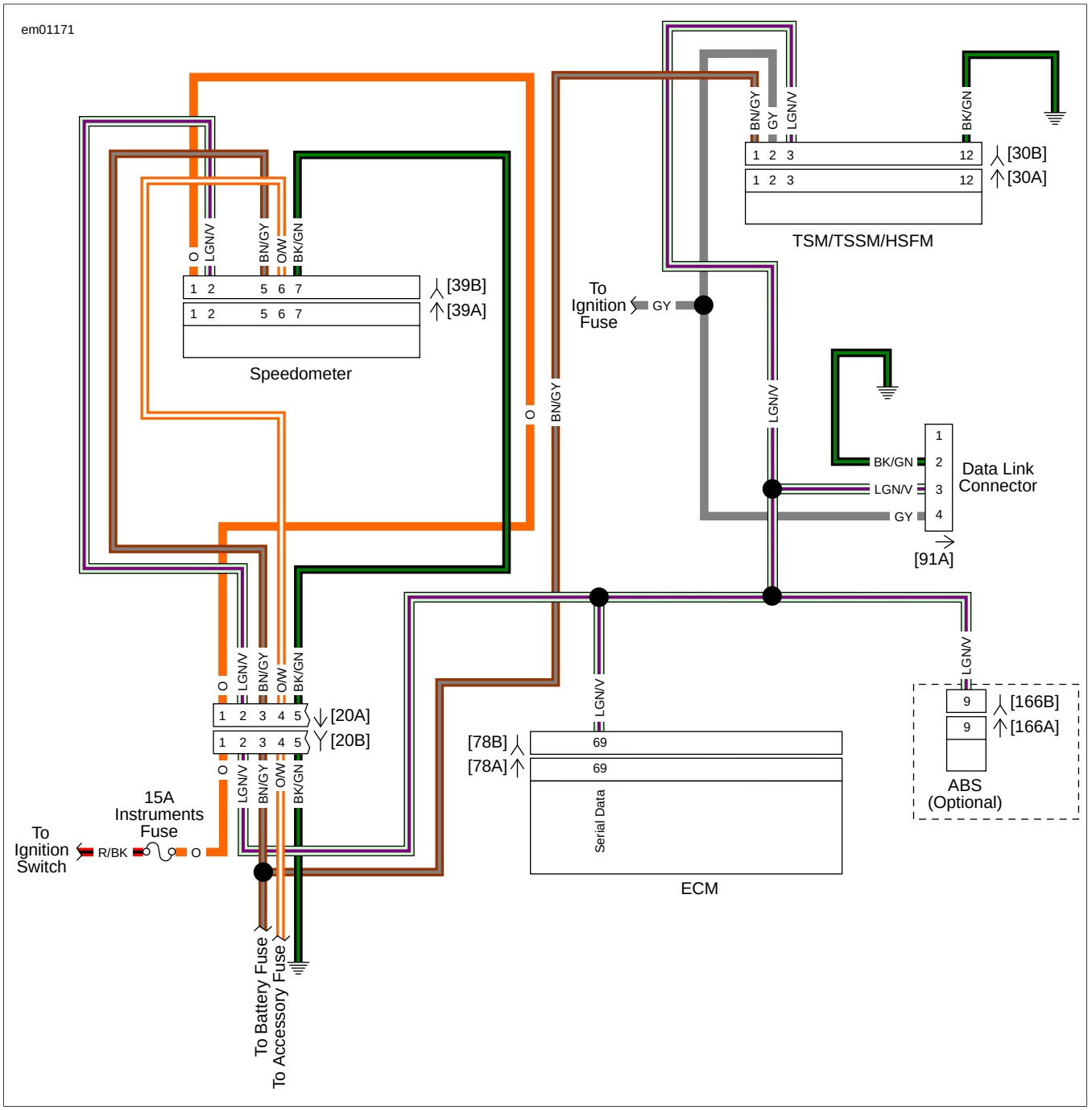


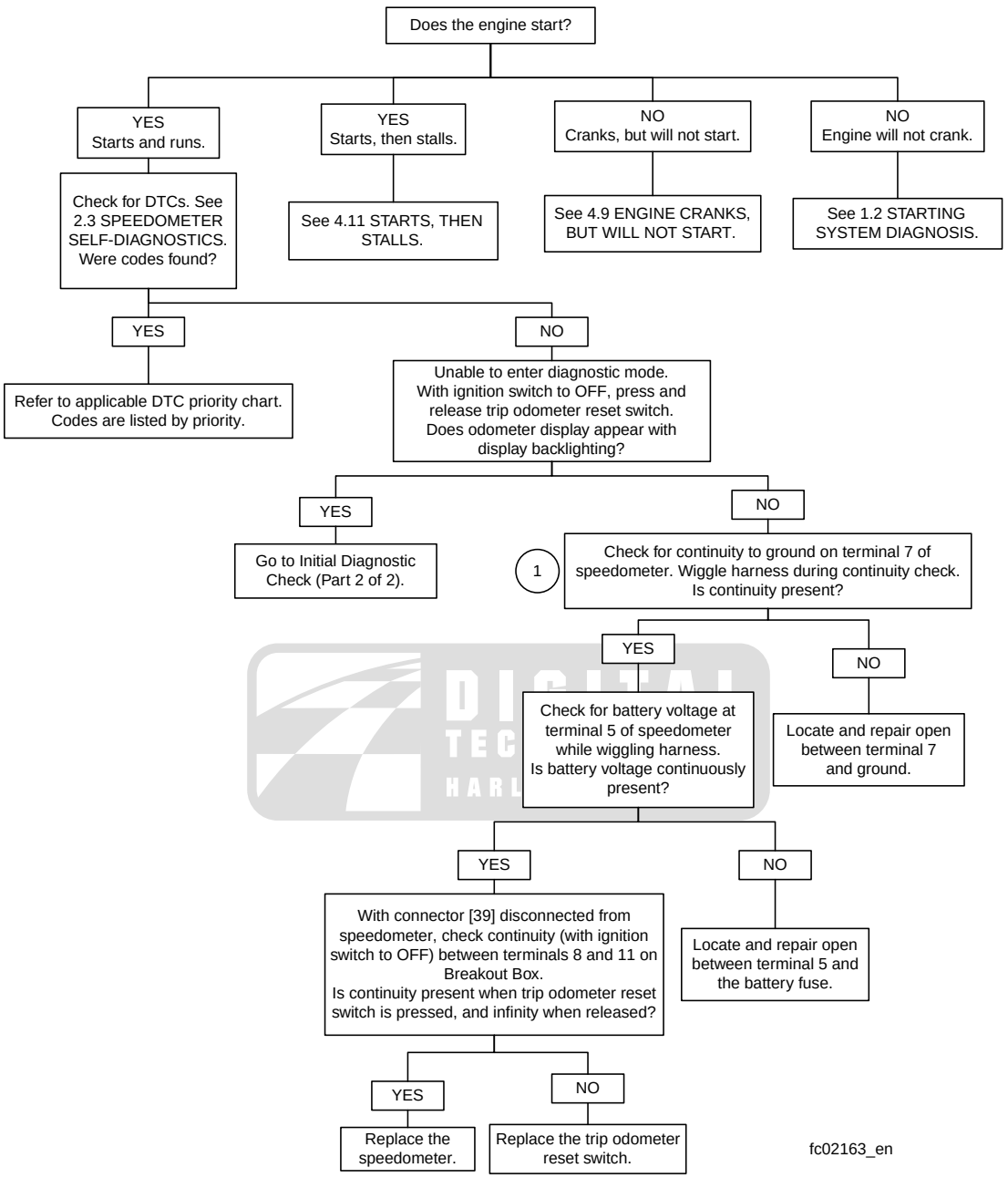
Figure 2-5. Diagnostic Check: FLHR/C

Table 2-4. Wire Harness Connectors

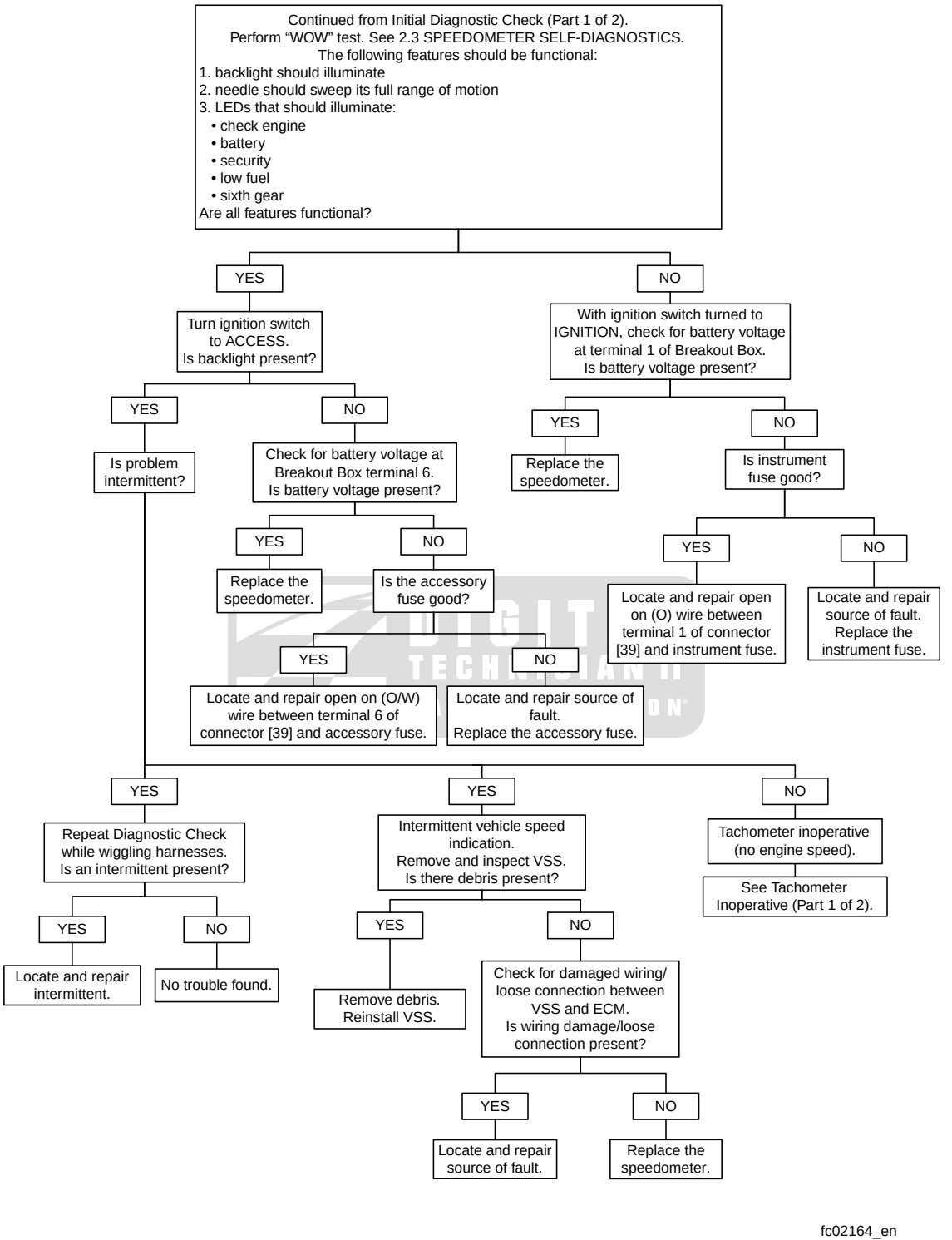
NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	16-place Molex	Under seat
[30]	TSM/TSSM/HFSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Packard	Back of speedometer (back of console)
[78]	ECM	73-place Packard	Under seat
[91]	DLC	4-place Deutsch	Under left side cover
[166]	ABS module	20-place Molex	Under right side cover

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Initial Diagnostic Check (Part 1 of 2)



Initial Diagnostic Check (Part 2 of 2)



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SPEEDOMETER SELF-DIAGNOSTICS 2.3

GENERAL

The speedometer is capable of displaying and clearing speedometer, tachometer, TSM/TSSM/HFSM, ECM, and ABS DTCs (diagnostic mode).

DIAGNOSTICS

Diagnostic Tips

- For a quick check of speedometer function, a "WOW" test can be performed. Press and hold trip odometer reset switch (Figure 2-1), then turn ignition switch to IGNITION. Release trip odometer reset switch. Background lighting should illuminate, gauge needle should sweep its full range of motion, and indicator lamps (check engine, low fuel, battery and security) should illuminate.
- If instrument module fails "WOW" test, check for battery, ground, ignition, trip odometer reset switch and accessory wiring to speedometer. If any feature in the speedometer is non-functional, see 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.

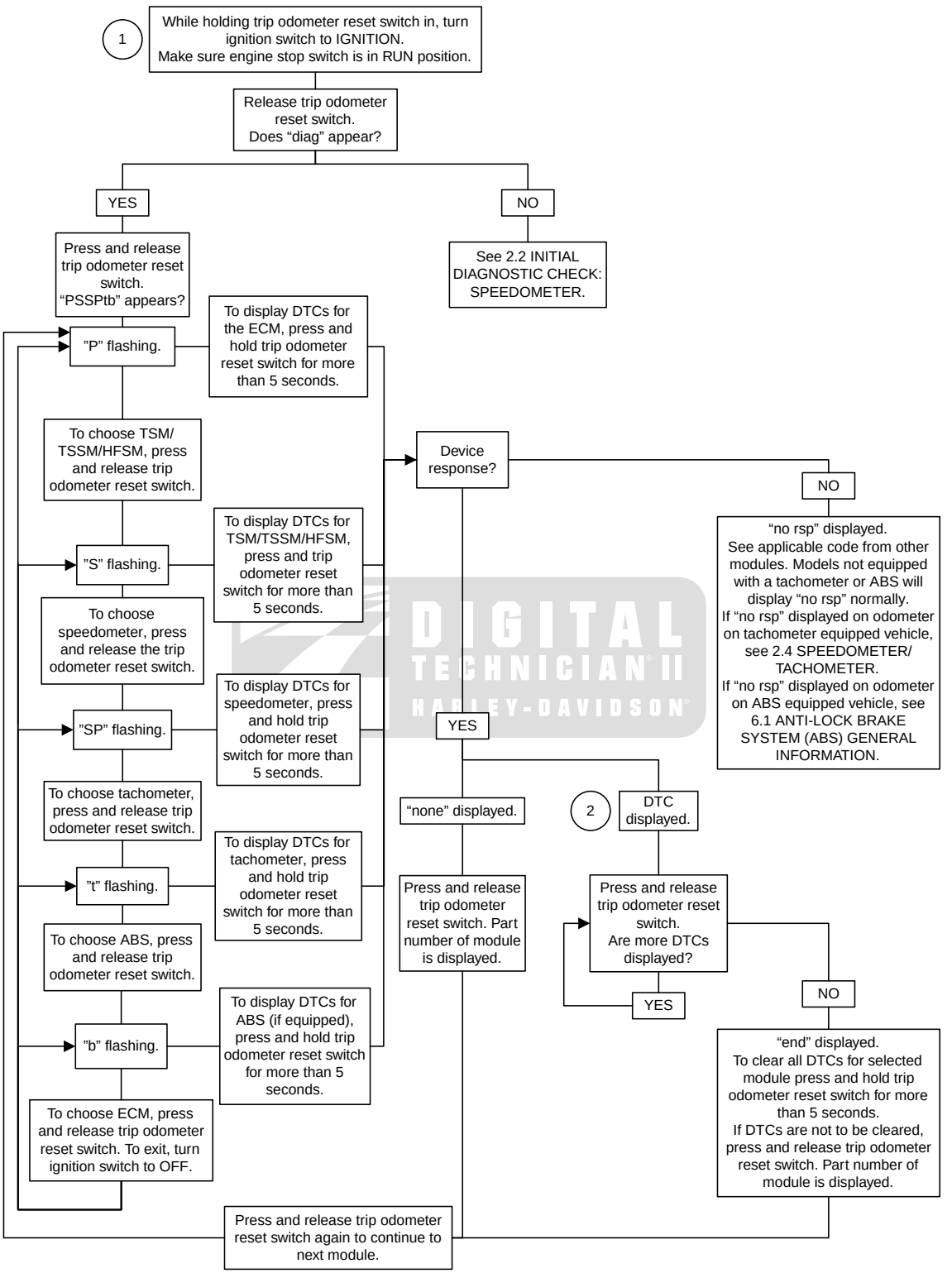
Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. To exit diagnostic mode, turn ignition switch to OFF.
2. To clear DTCs for the selected module:
 a. Press and hold the trip odometer reset switch for more than 5 seconds to display available modules, release.
 b. Press the trip odometer reset switch to choose the module.
 c. Press and hold the trip odometer reset switch for more than 5 seconds to display the DTC, release.
 d. Press and hold the trip odometer reset switch for more than 5 seconds to clear the DTCs for the selected module.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Speedometer Self-Diagnostics



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SPEEDOMETER/TACHOMETER 2.4

GENERAL

NOTE

Some icons may illuminate during "WOW" test even though the icon has no functionality on that vehicle.

The speedometer consists of a speedometer display and several icons. The icons include the sixth gear indicator, check engine, low fuel, battery, security, pursuit, ABS, and cruise enabled lamps.

Trip Odometer Reset Switch

Pressing the trip odometer reset switch provides the following capabilities:

- Change the odometer display (press and immediately release) between mileage, trip A and trip B values, fuel range, and clock (if equipped).
- Reset an individual trip odometer (press and hold 2-3 seconds).
- Gain access to the diagnostic mode, clear DTCs, and exit diagnostic mode. See 2.3 SPEEDOMETER SELF-DIAGNOSTICS.
- Display odometer while ignition switch is off. Press and hold trip odometer reset switch while ignition switch is off and odometer mileage will be displayed.
- On models with dual scale speedometers, toggle between miles/kilometers on odometer and trip odometer display. To toggle display, turn ignition switch to IGNITION. Press and hold trip odometer reset switch while odometer is displayed. Release trip odometer reset switch when change is noted. (If trip odometer reset switch is held while trip odometer is displayed, trip odometer will reset.)
- The trip odometer reset switch is also used to set or select the clock located in the odometer. The clock function for the odometer is not present on vehicles equipped with the advanced audio system. Detailed instructions for setting the clock are located in the Owner's Manual.

SPEEDOMETER THEORY OF OPERATION

The speedometer circuit consists of a VSS, the ECM, trip odometer reset switch and the speedometer. The VSS is mounted on the rear of the transmission case below the starter motor assembly. The sensor circuitry is that of a Hall-effect sensor triggered by the gear teeth of fifth gear on the transmission mainshaft.

The output from the sensor is a series of pulses that are interpreted by the ECM circuitry, converted into serial data then sent to the speedometer to control the position of the speedometer needle and the odometer LCD. The vehicle speed serial data is also transmitted to the TSM/TSSM/HFSM for turn signal cancellation.

ODOMETER THEORY OF OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The odometer mileage is permanently stored and is not lost when electrical power is turned off or disconnected. The trip odometer reset switch allows switching between the odometer, trip odometer A and trip odometer B values, fuel range, and clock (if equipped).

To zero the trip odometer, have the desired trip odometer display visible and press and hold the trip odometer reset switch. The trip odometer mileage is displayed for 2-3 seconds and then the trip mileage returns to zero miles.

The odometer can display six numbers to indicate a maximum of 999999 miles/kilometers. The trip odometers can display six numbers with a tenth of a mile accuracy for a maximum of 99999.9 miles/kilometers.

The speedometer indicates when the vehicle is in sixth gear. Selection of sixth gear is inferred as the system identifies when correct RPM and vehicle speed coincide.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values in DIGITAL TECHNICIAN II (Part No. HD-48650).

TACHOMETER THEORY OF OPERATION

The tachometer receives serial data from the ECM. The tachometer interprets the serial data and converts it into tachometer needle movement.

DIAGNOSTICS

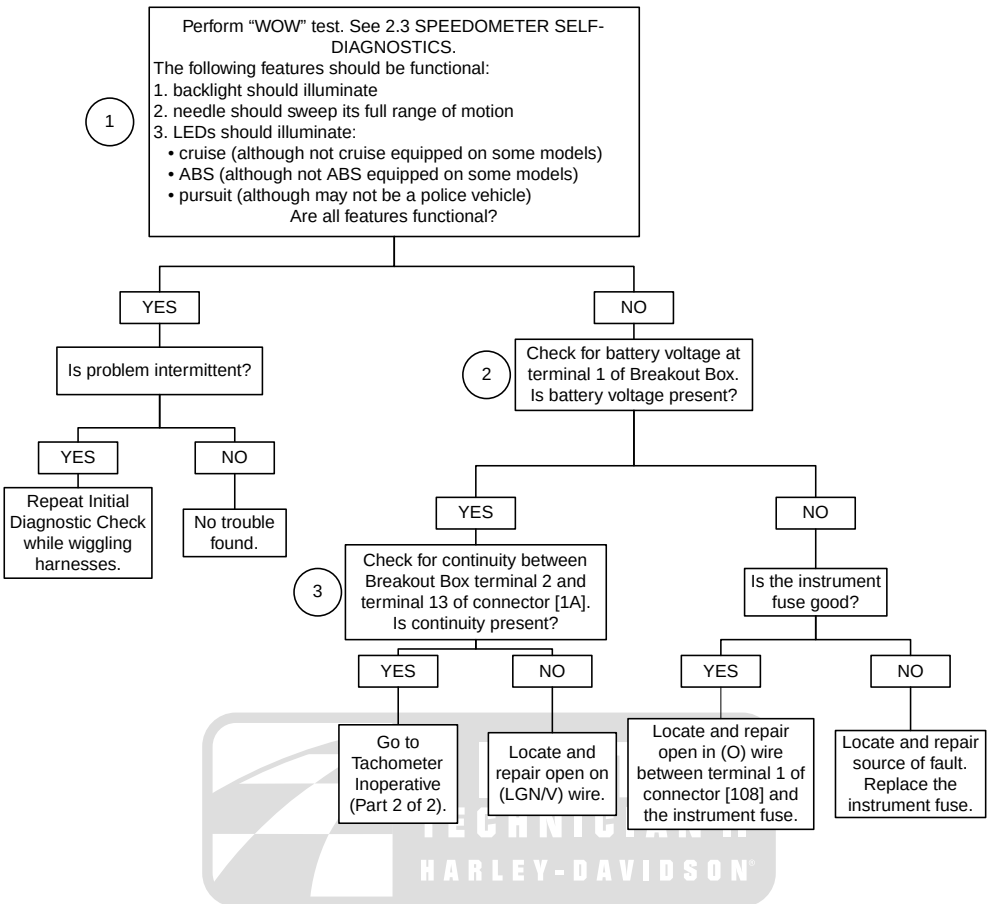
PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

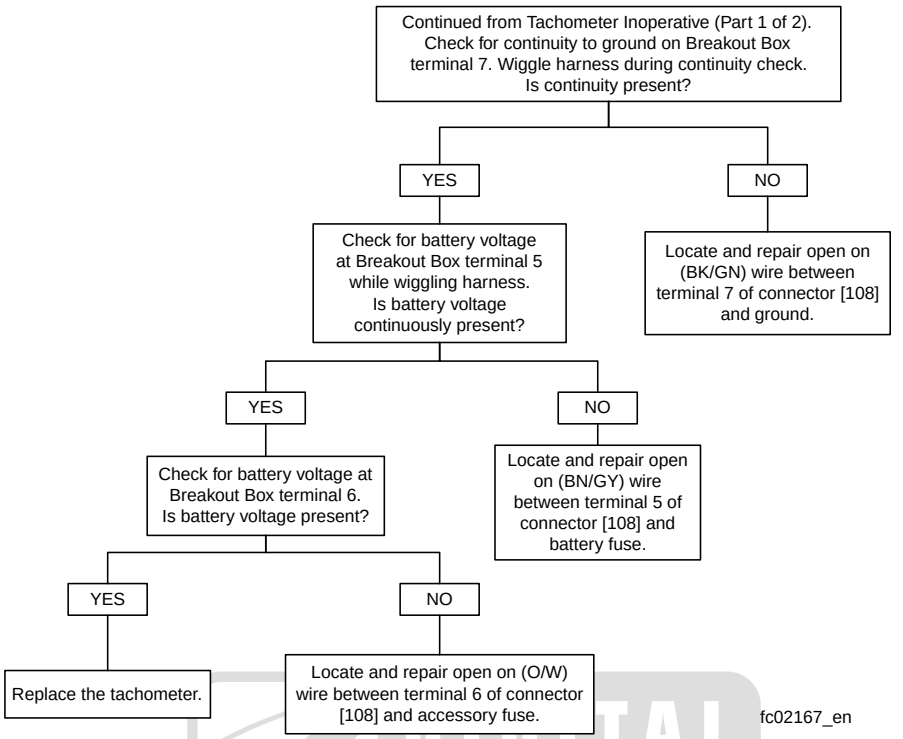
1. If problems are intermittent, wiggle harness while performing tests.
2. Connect BREAKOUT BOX (Part No. HD-42682) and INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) between wire harness and tachometer.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), black pin probe and patch cord.

Tachometer Inoperative (Part 1 of 2)



fc02166_en

Tachometer Inoperative (Part 2 of 2)



DIGITAL TECHNICIAN II HARLEY-DAVIDSON

BREAKOUT BOX: SPEEDOMETER/TACHOMETER 2.5

GENERAL

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

The BREAKOUT BOX (Part No. HD-42682) and INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) connect to speedometer connector [39]. Used in conjunction with a DVOM, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects.

NOTE

See wiring diagrams for speedometer terminal functions.

INSTALLATION

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

1. See Figure 2-6. Release the external latches and disconnect connector [39B].
2. See Figure 2-8. Connect INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) to connectors [39A] and [39B].
3. See Figure 2-7. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601).

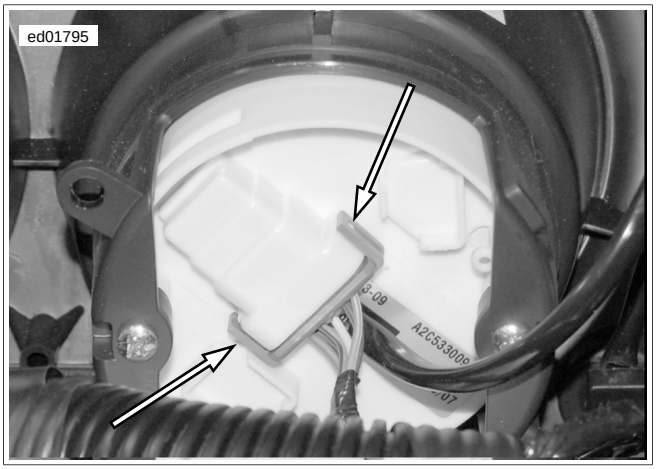


Figure 2-6. Speedometer Connector [39]

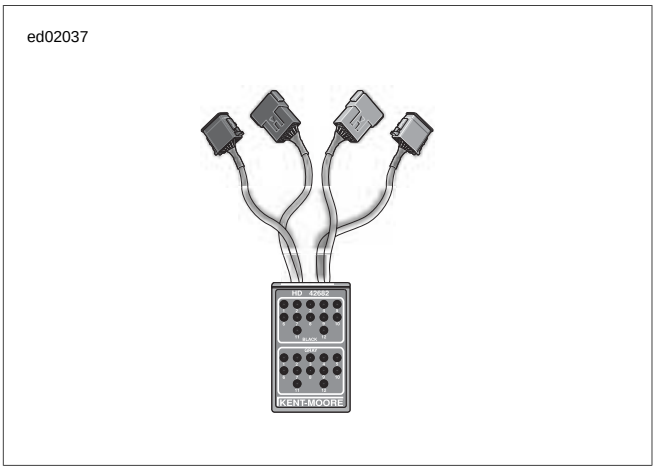


Figure 2-7. Breakout Box (Part No. HD-42682)

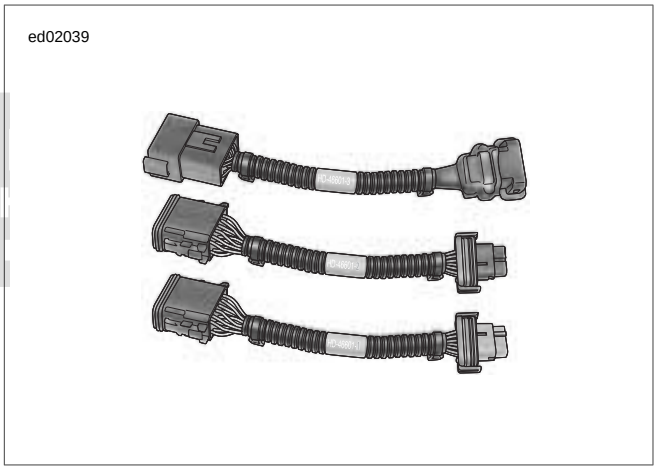


Figure 2-8. Instrument Harness Adapters (Part No. HD-46601)

REMOVAL

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

1. Detach connectors from BREAKOUT BOX (Part No. HD-42682) to INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601).
2. Detach INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601)from connectors [39A] and [39B].
3. Connect connector [39B] to speedometer.

FUEL GAUGE 2.6

THEORY OF OPERATION

See Figure 2-9. With ignition switch turned to IGNITION, the fuel gauge is connected to +12 Volts. Current flows through the gauge and variable resistor in the fuel gauge sending unit to ground. The sending unit float controls the amount of resistance in the variable resistor.

Inoperative gauges may be caused by any of the following:

- Sender or fuel gauge not grounded.
- Malfunction in sender or fuel gauge.
- Inoperative or disconnected wire from ignition switch to fuel gauge.
- Corroded connections at fuel gauge.

Use the 2.6 FUEL GAUGE, Fuel Gauge and Sender Test to test suspect components.

FUEL GAUGE AND SENDER TEST

PART NUMBER	TOOL NAME
HD-35500	MULTI-METER

NOTE

Always refer to the applicable wiring diagram when troubleshooting instruments or gauges.

1. Remove gauge. Ground (Y/W) wire of fuel level sender located at bottom of gauge. Turn ignition switch to IGNITION.
 a. Fuel gauge must indicate FULL. If gauge indicates FULL, gauge is functioning correctly. Proceed to step 2.
 b. If gauge did not indicate FULL, proceed to step 3.
2. Set MULTI-METER (Part No. HD-35500) to RXI scale to measure the resistance of the sending unit. Place one probe on (Y/W) and the other probe on chassis ground.
 a. If fuel tank is full, the reading should be 30-50 Ohms. An empty tank should have a 240-260 Ohms resistance. A half full tank is approximately 125-165 Ohms.
 b. If a very high resistance or infinity is indicated on the meter, the sender may be open or not grounded. Check that the sender and fuel tank are grounded by placing one probe of Multi-Meter on sender flange and the other probe on crankcase. Meter must indicate one Ohm or less. Replace sender if one Ohm or less was present. If a higher resistance is present, check for poor connection on ground wire.
3. Check voltage to (O/W) (+) and (BK) (-) wire of fuel gauge connector [117] if gauge did not indicate FULL.
 a. Correct reading is equivalent to battery voltage.
 b. If battery voltage is not present, check for inoperative or disconnected wire. Replace gauge if wiring problem is not found.

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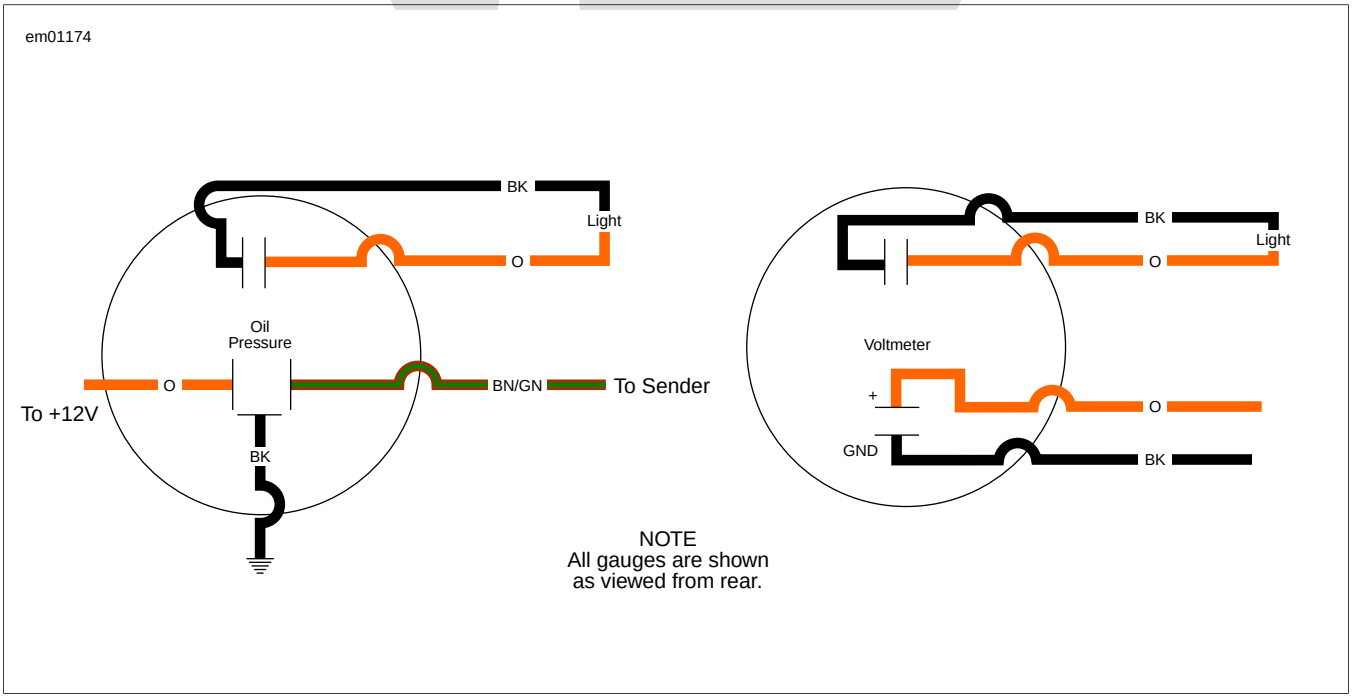


Figure 2-9. Connections for Gauges

OIL, AIR AND VOLTMETER GAUGES 2.7

OIL PRESSURE GAUGE AND INDICATOR LIGHT

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT

Problem

Low oil pressure light remains on with engine running above idle and/or oil pressure gauge does not work.

CAUTION

Do not operate the engine when the oil level is below the add mark on the dipstick at operating temperature. Engine damage will result. (00187b)

Table 2-5. Oil Pressure Gauge and Indicator Light

CAUSE	SOLUTION
No oil pressure due to lack of oil or faulty oil pump.	Check oil level. Add oil if low.
	Restart engine and verify oil pressure light goes off and gauge indicates pressure. If problem still exists, refer to oil pump in the service manual.
Contacts in pressure sending unit not opening to shut off light. Variable resistor in sender is shorted to ground.	Locate the oil pressure sending unit on the front right side of the crankcase.
	Verify the electrical connector is properly connected to the sending unit.
	If the oil pressure gauge indicates pressure but the low oil pressure light remains on proceed as follows: • Remove electrical connector from oil pressure sending unit. Using ohmmeter and HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) gray socket probe and patch cord, place one probe on indicator lamp terminal (closest to latch on sending unit), place the other probe on the crankcase. Ohmmeter must read less than one Ohm. • Start the engine and run at a fast idle. The ohmmeter must read infinity. • Replace the sending unit if the above meter readings are not obtained.
	If the low oil pressure light functions correctly, but the pressure gauge does not, then proceed as follows: • Remove electrical connector from oil pressure sending unit. Turn the ignition switch to IGNITION. The gauge must read zero. • Ground (BN/GN) wire terminal to crankcase. The gauge must read full scale 60 PSI (414 kPa). • Replace the sending unit if the above gauge readings are obtained. If the gauge readings are not obtained, then replace the pressure gauge.
No power to gauge.	See Voltmeter Gauge.

AMBIENT AIR TEMPERATURE GAUGE

Problem

Gauge inoperative.

Table 2-6. Ambient Air Temperature Gauge

CAUSE	SOLUTION
Sensor not grounded or open between sensor and gauge.	Test for continuity between terminal 1 and ground and terminal 3 and gauge. Repair if open.
Broken or disconnected power or ground wire to gauge.	Check for battery voltage between terminals 1 and 3 at connector [115A]. Replace gauge if voltage is present. Use voltage drop tests and continuity checks to isolate if voltage is not present.
Malfunction in gauge or sensor.	Measure resistance between terminals 1 and 3 at 65-85 °F (18.3-29.4 °C). Resistance should be 31-43 Ohms. Replace sensor if out of range, replace gauge if within range.

VOLTMETER GAUGE

Problem

Meter inoperative.

Table 2-7. Voltmeter Gauge

CAUSE	SOLUTION
Inoperative or disconnected leads to meter or open meter winding.	With ignition switch turned to IGNITION, verify battery voltage is present at both positive and negative terminals on the voltmeter terminal on voltmeter. With ignition switch turned to OFF, check ground terminal for continuity to ground.
	Replace the voltmeter if battery voltage is present and ground terminal is grounded.
	If battery voltage is not present, trace wiring until disconnected or inoperative wire is found and repair as necessary. If ground terminal is not grounded, refer to wiring diagram and repeat procedure given for 12V lead.

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INDICATOR LIGHTS: ALL 2.8

GENERAL

See Figure 2-10 and Figure 2-11. All models are equipped with LED indicators. The indicator lights assembly is not serviceable. If one LED is bad, the entire assembly must be replaced.

Table 2-8. Indicator Lamp Connector [21] (All But FLHR/C/S)

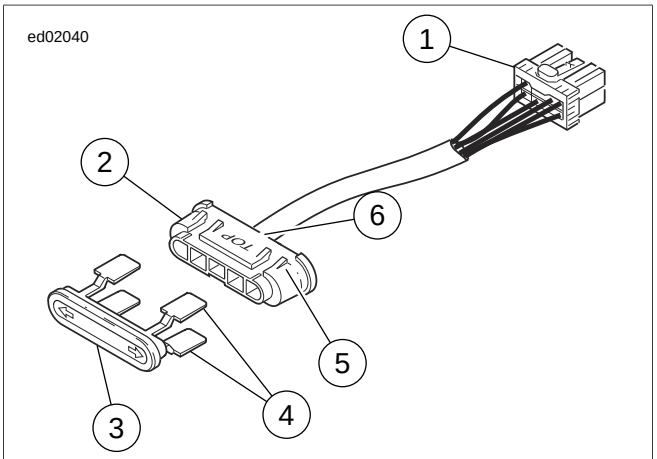
TERMINAL	WIRE COLOR	FUNCTION
1	Brown	Right Turn Power
2	Green/Yellow	Oil Pressure Lamp To Switch
3	White	High Beam Power
4	Violet	Left Turn Power
5	Black	Ground
6	Orange	Neutral/Oil Pressure Power
7	Tan	Neutral Lamp To Switch
8	Not Used	N/A
9	Not Used	N/A
10	Not Used	N/A

Table 2-9. Indicator Lamp Connector [21] (FLHR/C/S)

TERMINAL	WIRE COLOR	FUNCTION
1	Violet	Left Turn Power
2	White	High Beam Power
3	Green/Yellow	Oil Pressure Lamp To Switch
4	Brown	Right Turn Power
5	Tan	Neutral Lamp To Switch
6	Orange	Neutral/Oil Pressure Power
7	Black	Ground
8	Not Used	N/A

Table 2-10. Indicator Lamp Wiring

INDICATOR LAMP	CONNECTION
Oil pressure	Ground through switch
Neutral	Ground through harness
High beam	12V when active
Right/left turn	12V when active



1. **Indicator lights connector**
2. **Indicator lights assembly**
3. **Lens**
4. **Paddles**
5. **Index tabs**
6. **Orientation stamp**

Figure 2-10. Indicator Lights Assembly (FLHT/C/U, FLTR)

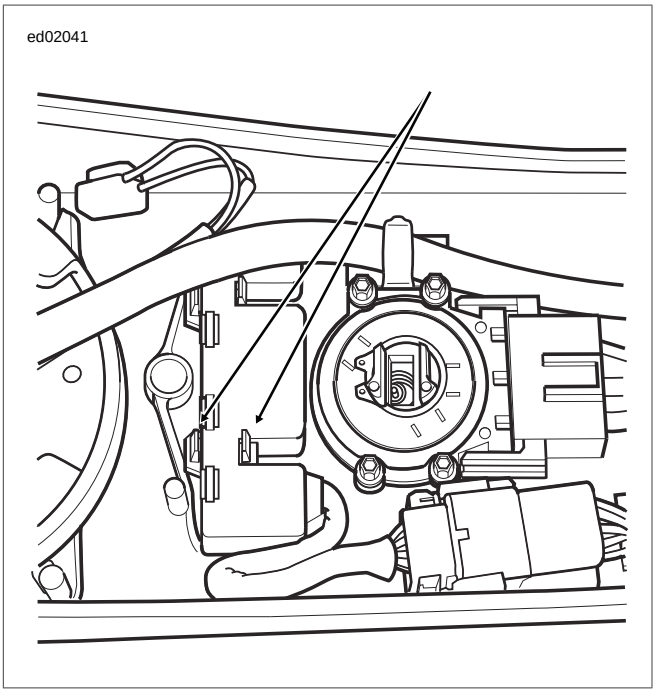


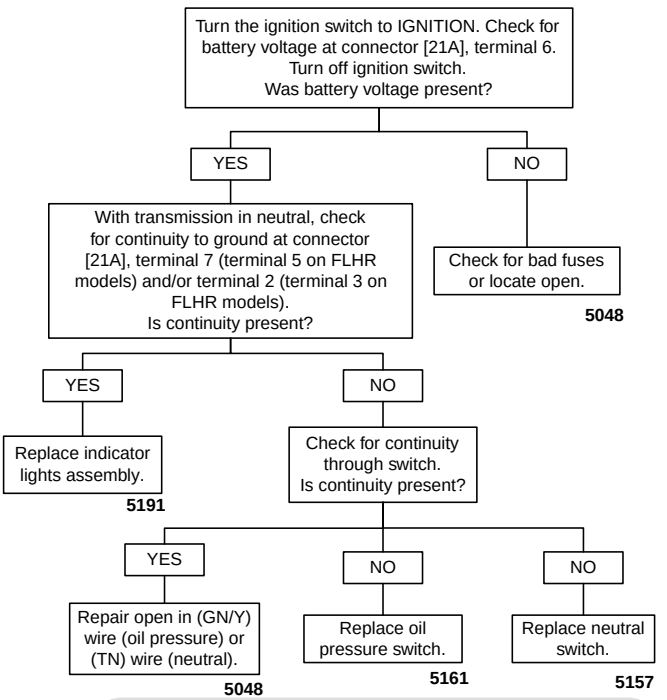
Figure 2-11. Release Paddles to Free Indicator Light Assembly (FLHR/C)

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

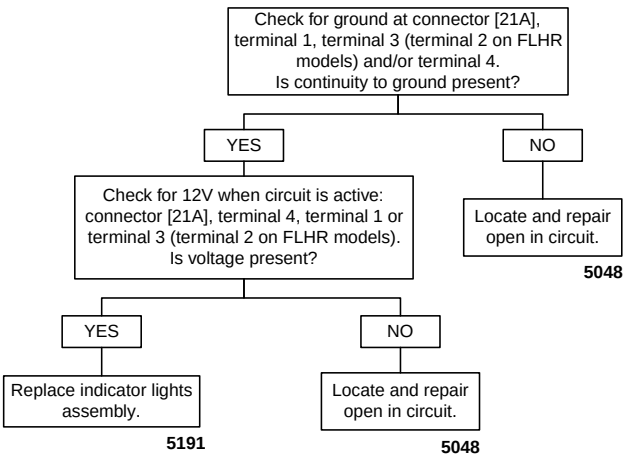
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Oil Pressure or Neutral Indicator Will Not Function



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High Beam or Right/Left Turn Signal Indicator Will Not Function



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DTC B1004, B1005 2.9

GENERAL

See Figure 2-12. The fuel level is monitored by the speedometer terminal 9 of connector [39] (Y/W).

- If the voltage on terminal 9 of connector [39] exceeds the lower limit for greater than or equal to 15 seconds, DTC B1004 sets.
- If the voltage on terminal 9 of connector [39] exceeds the upper limit (or is open) for greater than or equal to 15 seconds, DTC B1005 sets.

Table 2-11. Code Description

DTC	DESCRIPTION
B1004	Fuel level sending unit low
B1005	Fuel level sending unit high/open

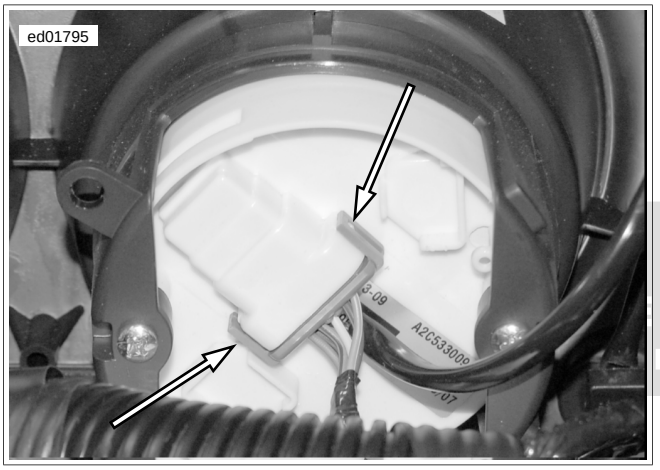


Figure 2-12. Speedometer Connector [39]

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Tips

If fuel gauge is performing erratically (possible false DTCs), inspect for unobstructed movement of sending unit arm. Repair or align as necessary.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. See Figure 2-14. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown pin probe and patch cord.
2. See Figure 2-13. Connect BREAKOUT BOX (Part No. HD-42682) and INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) between wire harness and speedometer.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord.

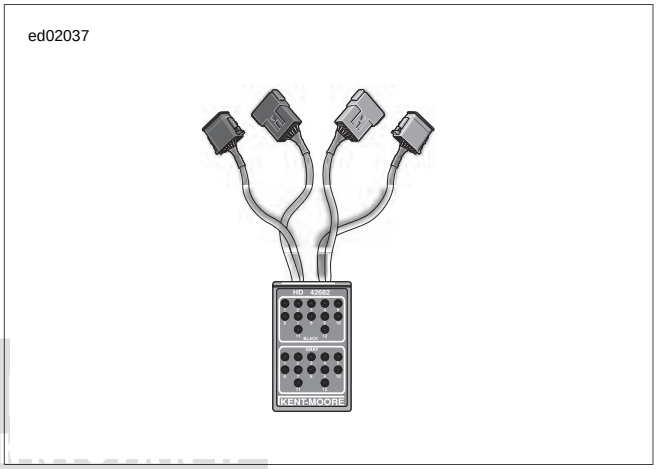


Figure 2-13. Breakout Box (Part No. HD-42682)



Figure 2-14. Instrument Harness Adapters (Part No. HD-46601)

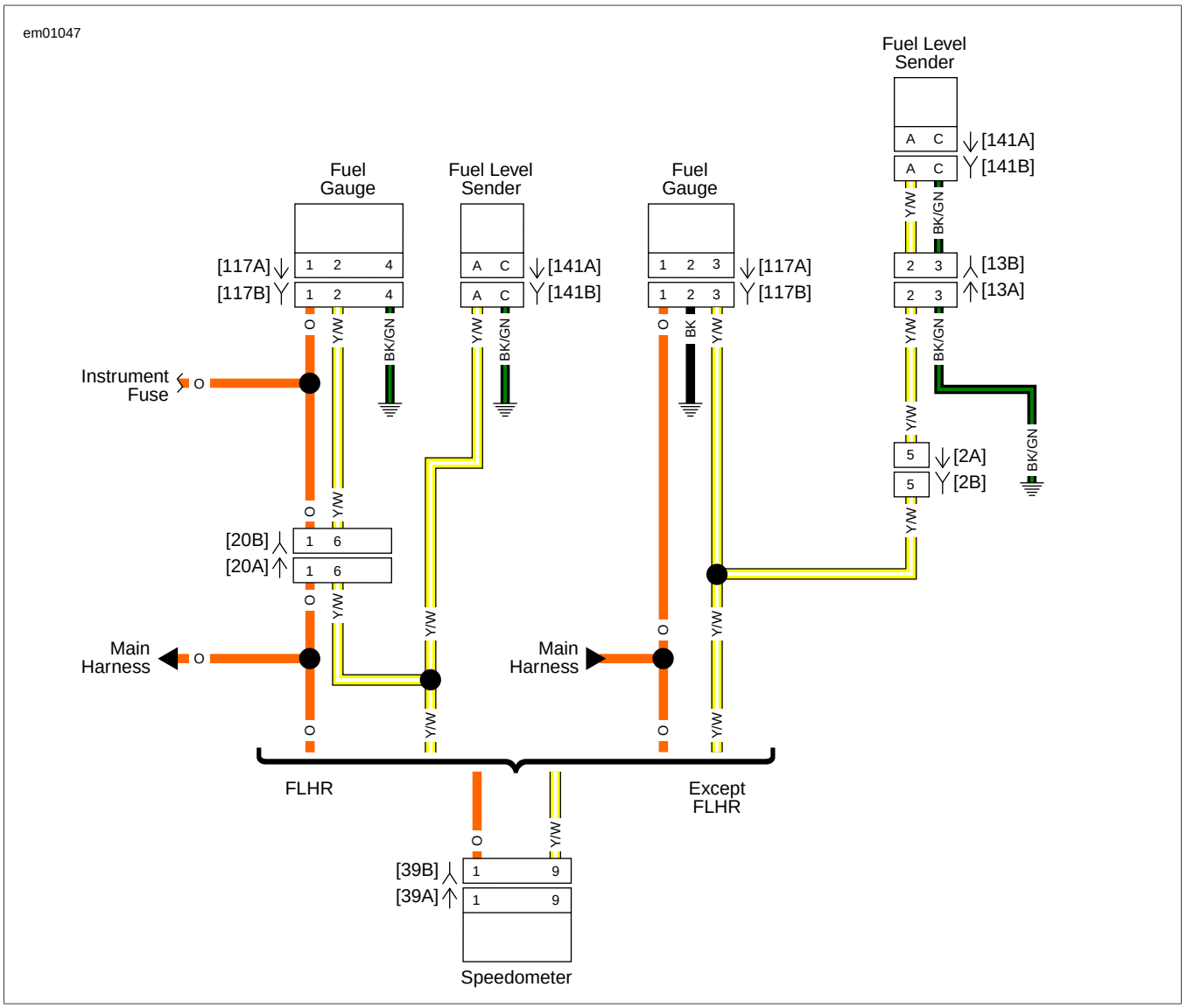


Figure 2-15. Fuel Sender Circuit

Table 2-12. Wire Harness Connectors

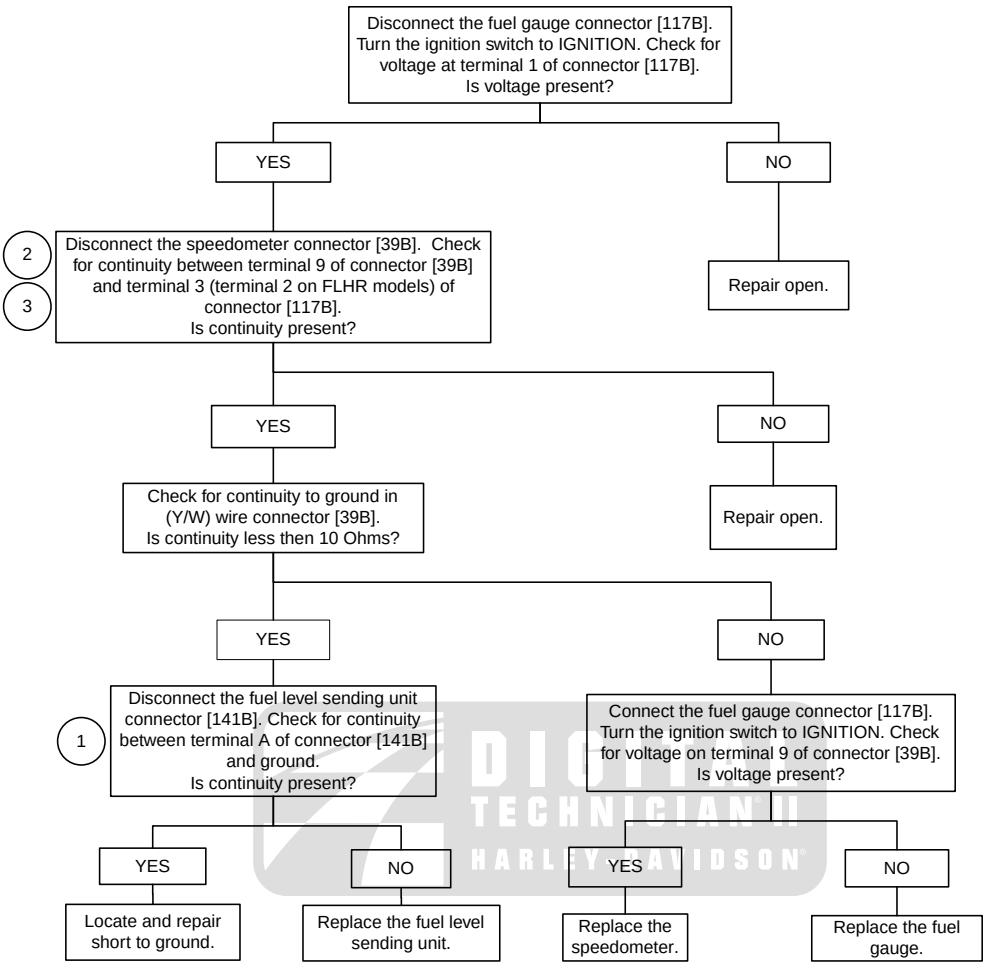
NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[2]	Main to interconnect harness	FLHX, FLHT/C/U, FLTR	12-place Molex (gray)	Inner fairing - left radio support bracket
[13]	Fuel tank harness	FLHX, FLHT/C/U, FLTR	4-place Multilock	Behind fuel tank (under seat)
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[39]	Speedometer	FLHX, FLHT/C/U	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
		FLHR/C	12-place Packard	Back of speedometer (back of console)
[78]	ECM	All	73-place Packard	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover

Table 2-12. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[117]	Fuel gauge	FLHR/C	4-place Tyco	Below fuel tank - left side
		All except FLHR	3-place Continental	Inner fairing - back of fuel gauge
[141]	Fuel level sender	All	4-place Packard	Top of canopy (under console)

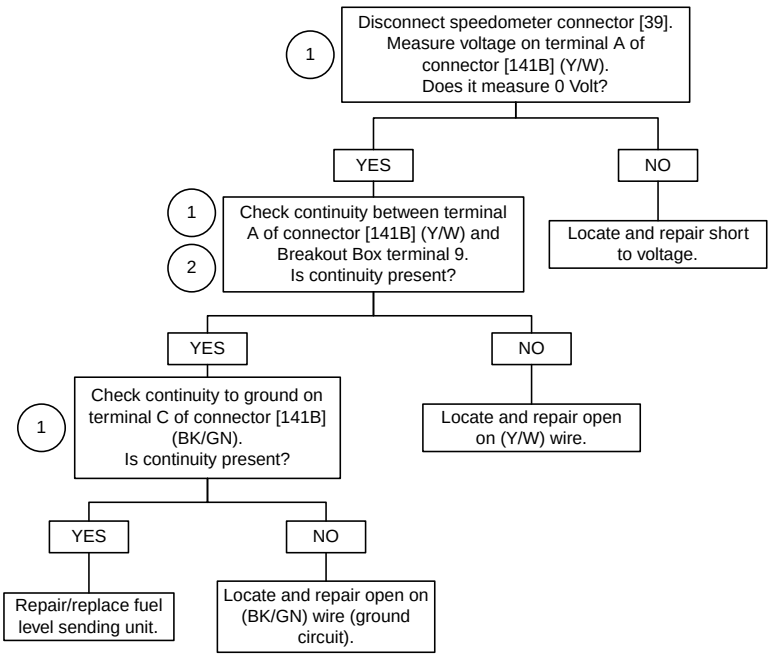
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DTC B1004



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DTC B1005



Clear codes using speedometer self-diagnostics. See 2.3 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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DTC B1006, B1007 2.10

GENERAL

Accessory or Ignition Line Overvoltage

Ignition and accessory voltage is constantly monitored by the speedometer (terminal 1 ignition and terminal 6 accessory). If the battery voltage fails to meet normal operating parameters, a DTC is set.

- DTC B1006 is displayed when accessory line voltage is greater than 16.0 Volts for longer than 5 seconds.
- DTC B1007 is displayed when ignition line voltage is greater than 16.0 Volts for longer than 5 seconds.

NOTE

ECM or TSM/TSSM/HFSM may also set a battery voltage DTC.

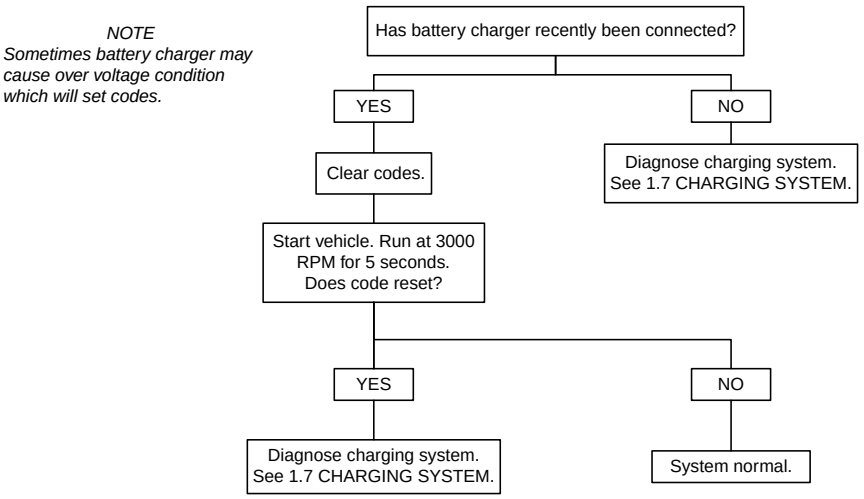
Table 2-13. Code Description

DTC	DESCRIPTION
B1006	Accessory line overvoltage
B1007	Ignition line overvoltage

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DTCs B1006 and B1007

NOTE
Sometimes battery charger may cause over voltage condition which will set codes.



Clear codes using speedometer self-diagnostics. See 2.3 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1008 2.11

GENERAL

Trip Odometer Reset Switch Closed

DTC B1008 sets if trip odometer reset switch terminals are in a constant shorted state.

Table 2-14. Code Description

DTC	DESCRIPTION
B1008	Trip odometer reset switch closed

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Disconnect speedometer connector [39] (at the back of the speedometer). See 2.5 BREAKOUT BOX: SPEEDOMETER/TACHOMETER.
2. Connect BREAKOUT BOX (Part No. HD-42682) (black) to wire harness connector [39B] using INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601), leaving speedometer disconnected.

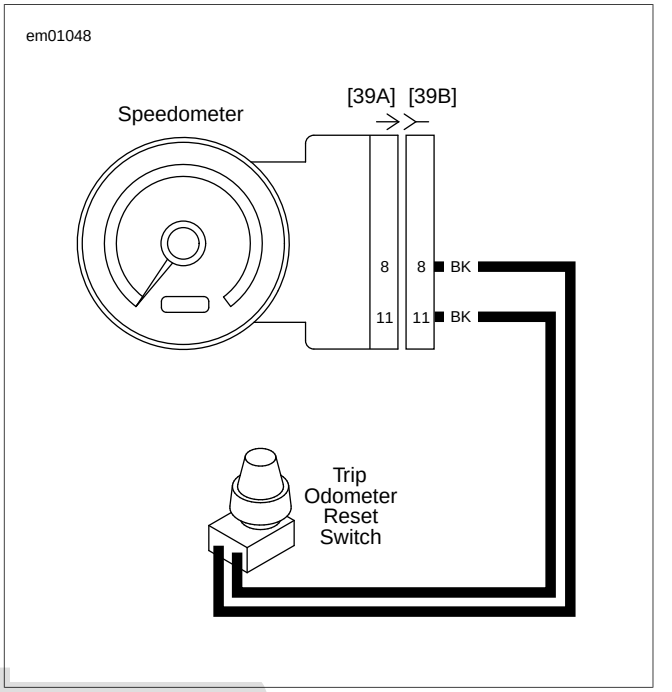
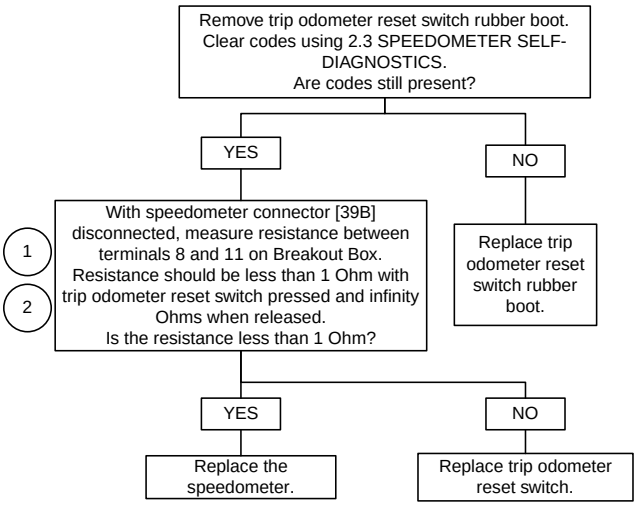


Figure 2-16. Trip Odometer Reset Switch Circuit

Table 2-15. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[39]	Speedometer	FLHX, FLHT/C/U	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
		FLHR	12-place Packard	Back of speedometer (back of console)

DTC B1008



Clear codes using speedometer self-diagnostics. See 2.3 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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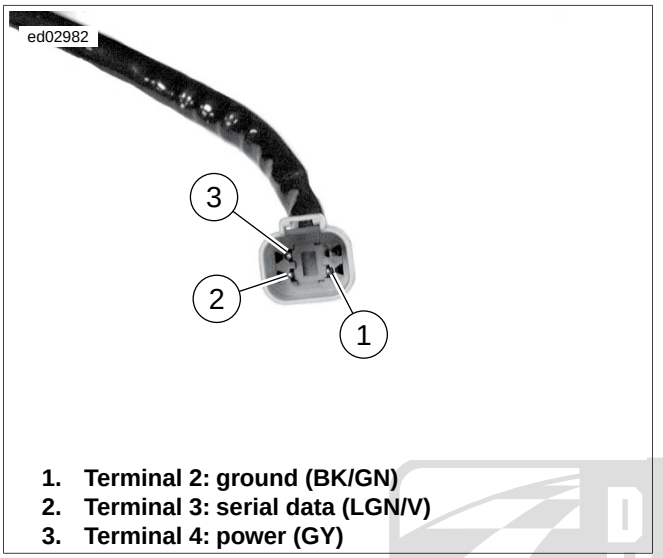
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DTC U1016 2.12

GENERAL

Loss of ECM Serial Data

See Figure 2-17. The DLC provides a means for the ECM, TSM/TSSM/HFSM and speedometer to communicate their current status. When all operating parameters on the serial data bus are within specifications, a state of health message is sent between the components. DTC U1016 indicates that the ECM is not capable of sending this state of health message.



1. **Terminal 2: ground (BK/GN)**
2. **Terminal 3: serial data (LGN/V)**
3. **Terminal 4: power (GY)**

Figure 2-17. Data Link Connector

Table 2-16. Code Description

DTC	DESCRIPTION
U1016	Loss of all ECM serial data (state of health)
	Loss of vehicle speed
	Loss of vehicle inhibit motion
	Loss of powertrain security status

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/TSSM/HFSM connector [30A] and wire harness connector [30B]. See 3.12 BREAKOUT BOX: TSM/HFSM.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

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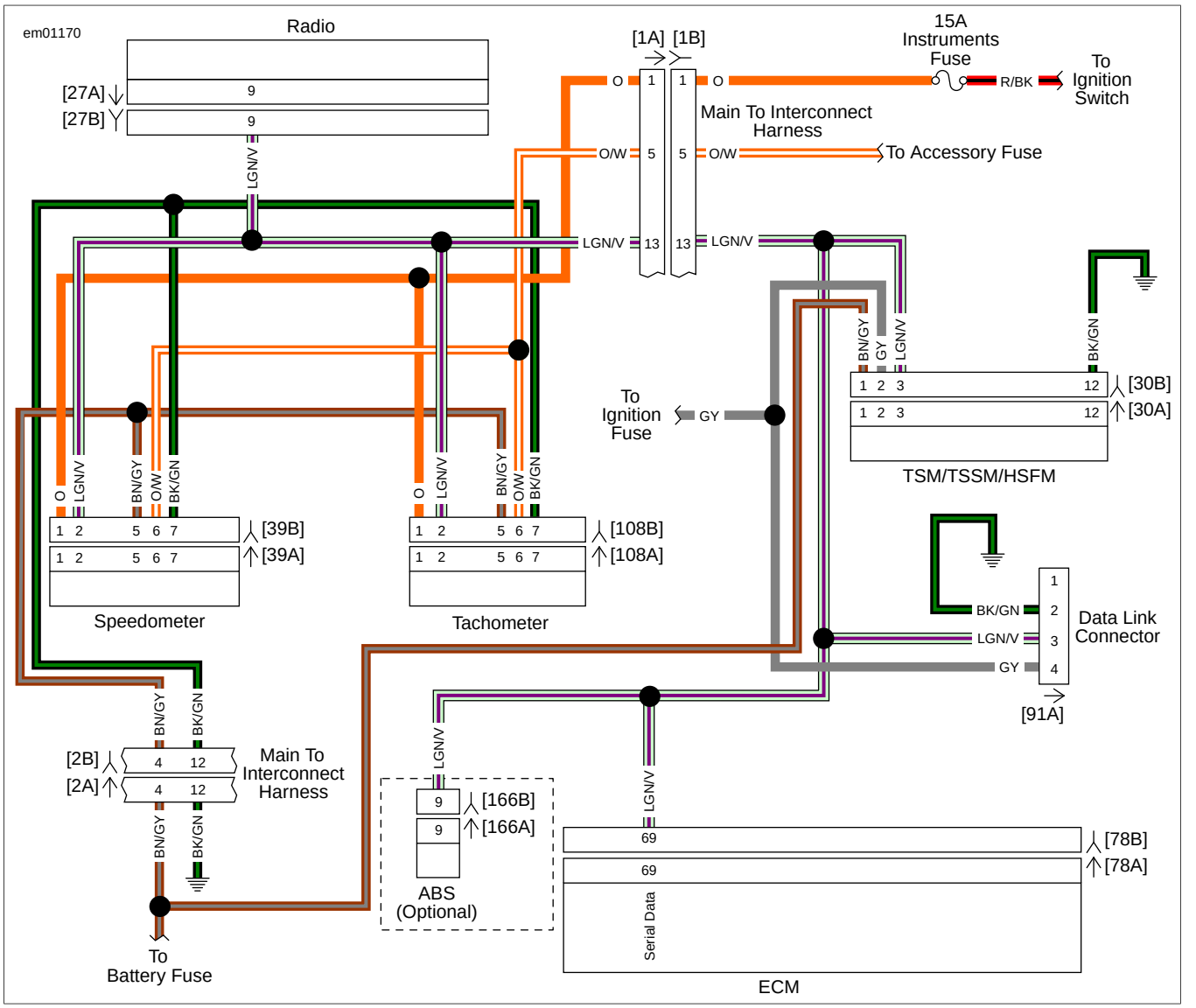


Figure 2-18. Serial Data Circuit: FLHX, FLHT/C/U, FLTR

Table 2-17. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHX, FLHT/C/U	16-place Molex (black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (black)	Inner fairing - right side (below radio)
[2]	Main to interconnect harness	All	12-place Molex (gray)	Inner fairing - left radio support bracket
[27]	Radio	All	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[30]	TSM/TSSM/HFSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHX, FLHT/C/U	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
[78]	ECM	All	73-place Packard	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover

Table 2-17. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[108]	Tachometer	FLHX, FLHT/C/U	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)
[166]	ABS module	All	20-place Molex	Under right side cover

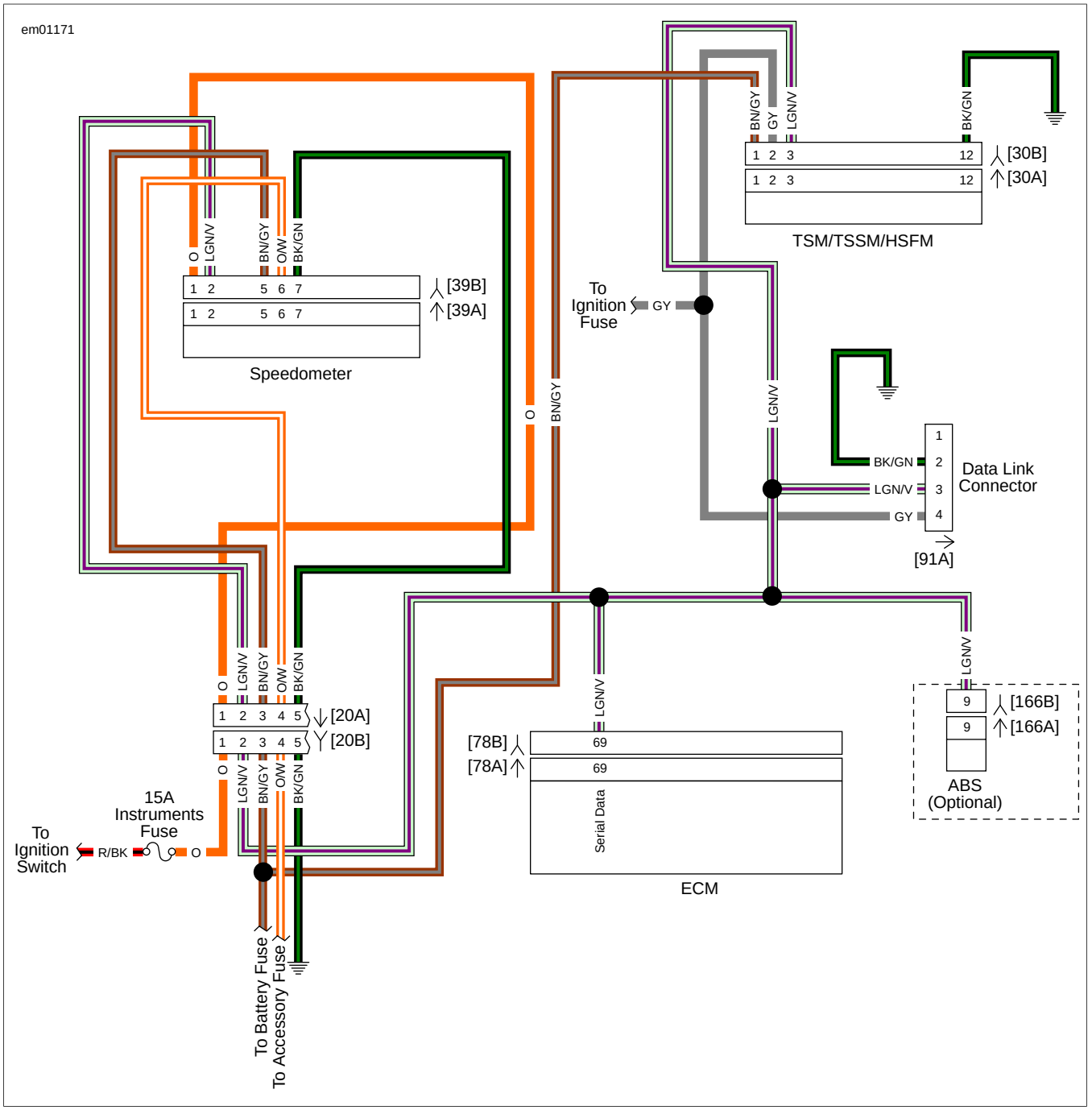


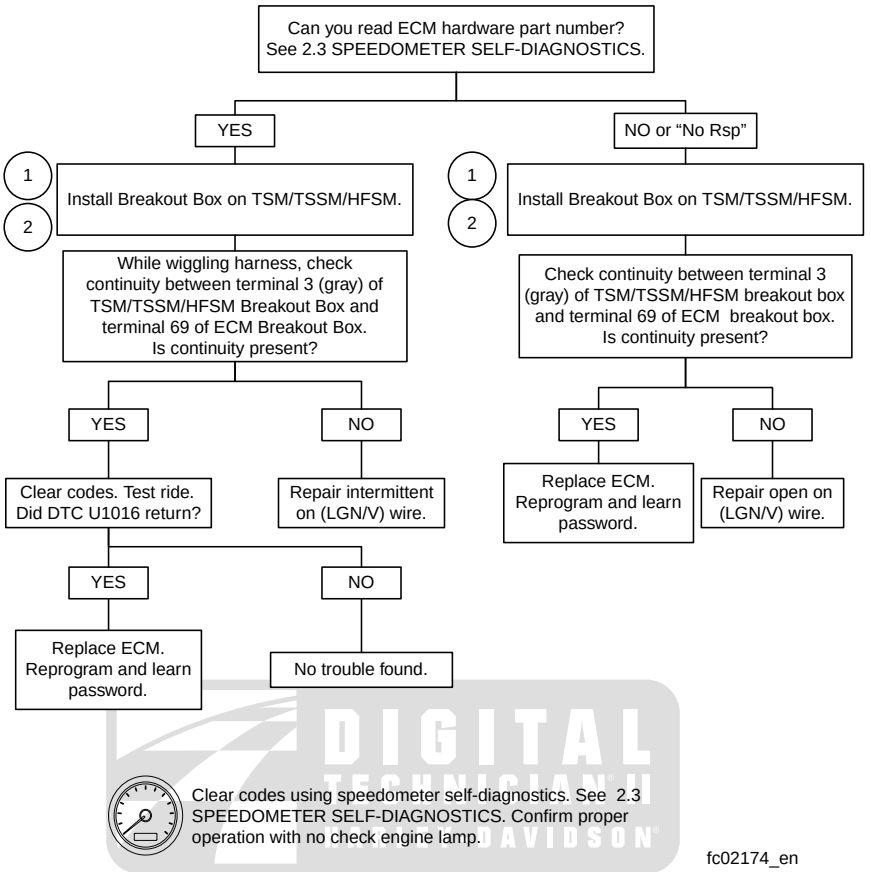
Figure 2-19. Serial Data Circuit: FLHR/C

Table 2-18. FLHR Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	16-place Molex	Under seat
[30]	TSM/TSSM/HFSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Packard	Back of speedometer (back of console)
[78]	ECM	73-place Packard	Under seat
[91]	DLC	4-place Deutsch	Under left side cover
[166]	ABS module	20-place Molex	Under right side cover

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC U1016

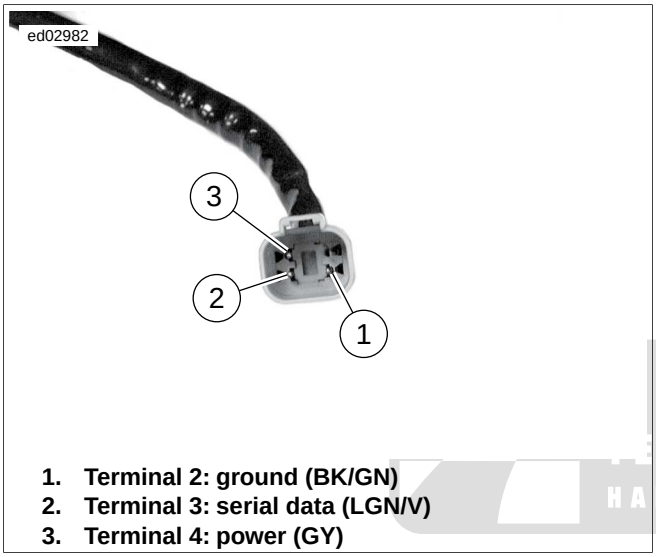

Can you read ECM hardware part number? See 2.3 SPEEDOMETER SELF-DIAGNOSTICS.
YES
NO or “No Rsp”
1
2
Install Breakout Box on TSM/TSSM/HFSM.
1
2
Install Breakout Box on TSM/TSSM/HFSM.
While wiggling harness, check continuity between terminal 3 (gray) of TSM/TSSM/HFSM Breakout Box and terminal 69 of ECM Breakout Box. Is continuity present?
Check continuity between terminal 3 (gray) of TSM/TSSM/HFSM breakout box and terminal 69 of ECM breakout box. Is continuity present?
YES
NO
YES
NO
Clear codes. Test ride. Did DTC U1016 return?
Repair intermittent on (LGN/V) wire.
Replace ECM. Reprogram and learn password.
Repair open on (LGN/V) wire.
YES
NO
Replace ECM. Reprogram and learn password.
No trouble found.
Clear codes using speedometer self-diagnostics. See 2.3 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.
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DTC U1064, U1255 2.13

GENERAL

Loss of TSM/TSSM/HFSM Serial Data

See Figure 2-20. The DLC provides a means for the ECM, TSM/TSSM/HFSM and speedometer to communicate their current status. When all operating parameters on the serial data bus are within specifications, a state of health message is sent between the components. DTC U1255 (only reported by the TSM/TSSM/HFSM or speedometer) indicates that no messages were present during power up of the current key cycle. DTC U1064 indicates there was communication on the data bus since power up, but was lost or interrupted during that key cycle.



1. **Terminal 2: ground (BK/GN)**
2. **Terminal 3: serial data (LGN/V)**
3. **Terminal 4: power (GY)**

Figure 2-20. Data Link Connector

Table 2-19. Code Description

DTC	DESCRIPTION
U1064	Loss of TSM/TSSM/HFSM serial data
U1255	Serial data error/missing message

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) as follows:
 a. Mate black socket housing on BREAKOUT BOX (Part No. HD-42682) with speedometer connector [39] using INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601).
 b. Mate black pin housing on BREAKOUT BOX (Part No. HD-42682) with speedometer harness connector [39B] using INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601).
 c. Mate gray socket housing on BREAKOUT BOX (Part No. HD-42682) with TSM/TSSM/HFSM connector [30A].
 d. Mate gray pin housing on BREAKOUT BOX (Part No. HD-42682) with harness connector [30B].

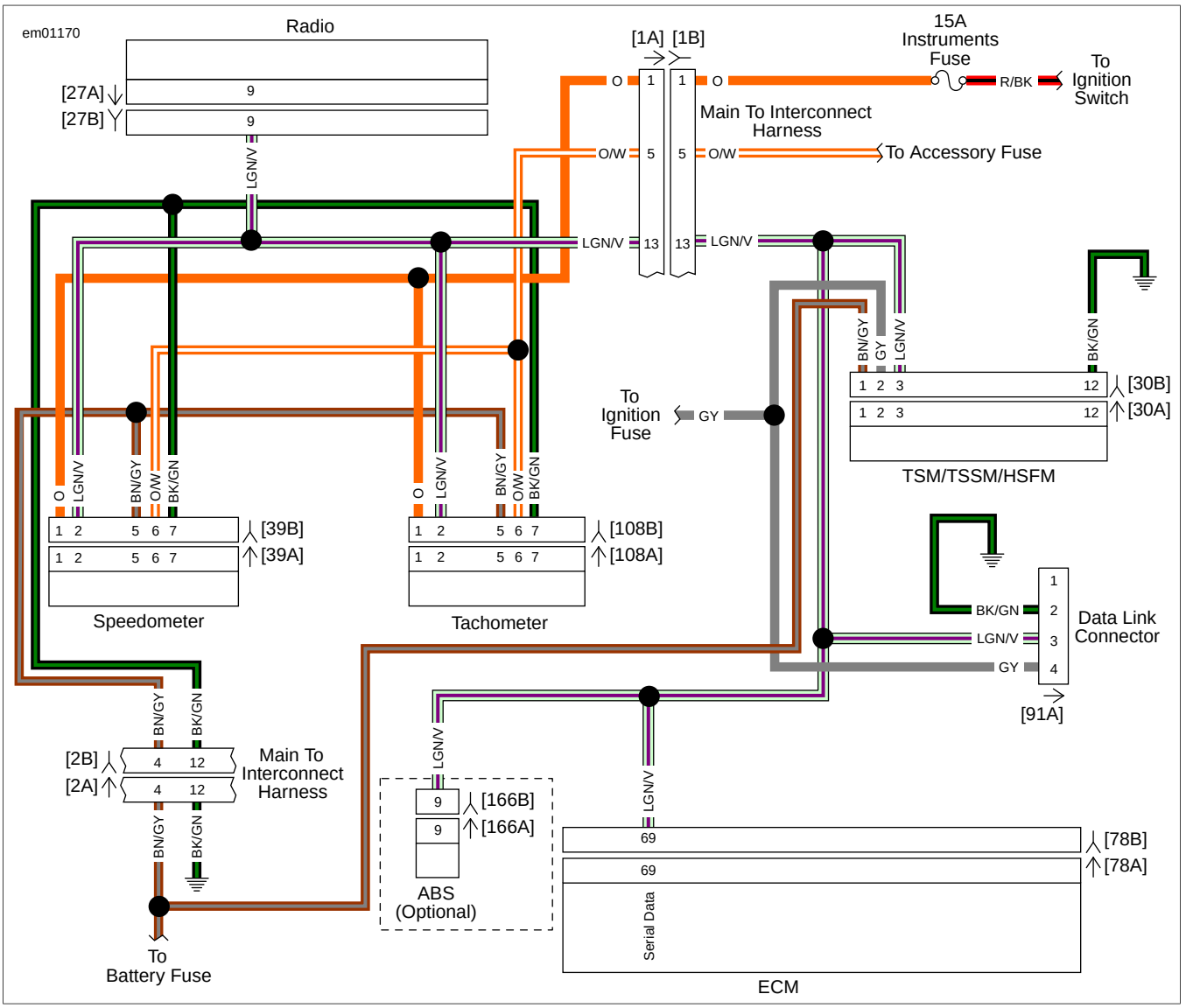


Figure 2-21. Serial Data Circuit: FLHX, FLHT/C/U, FLTR

Table 2-20. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHX, FLHT/C/U	16-place Molex (black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (black)	Inner fairing - right side (below radio)
[2]	Main to interconnect harness	All	12-place Molex (gray)	Inner fairing - left radio support bracket
[27]	Radio	All	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[30]	TSM/TSSM/HFSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHX, FLHT/C/U	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
[78]	ECM	All	73-place Packard	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover

Table 2-20. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[108]	Tachometer	FLHX, FLHT/C/U	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)
[166]	ABS module	All	20-place Molex	Under right side cover

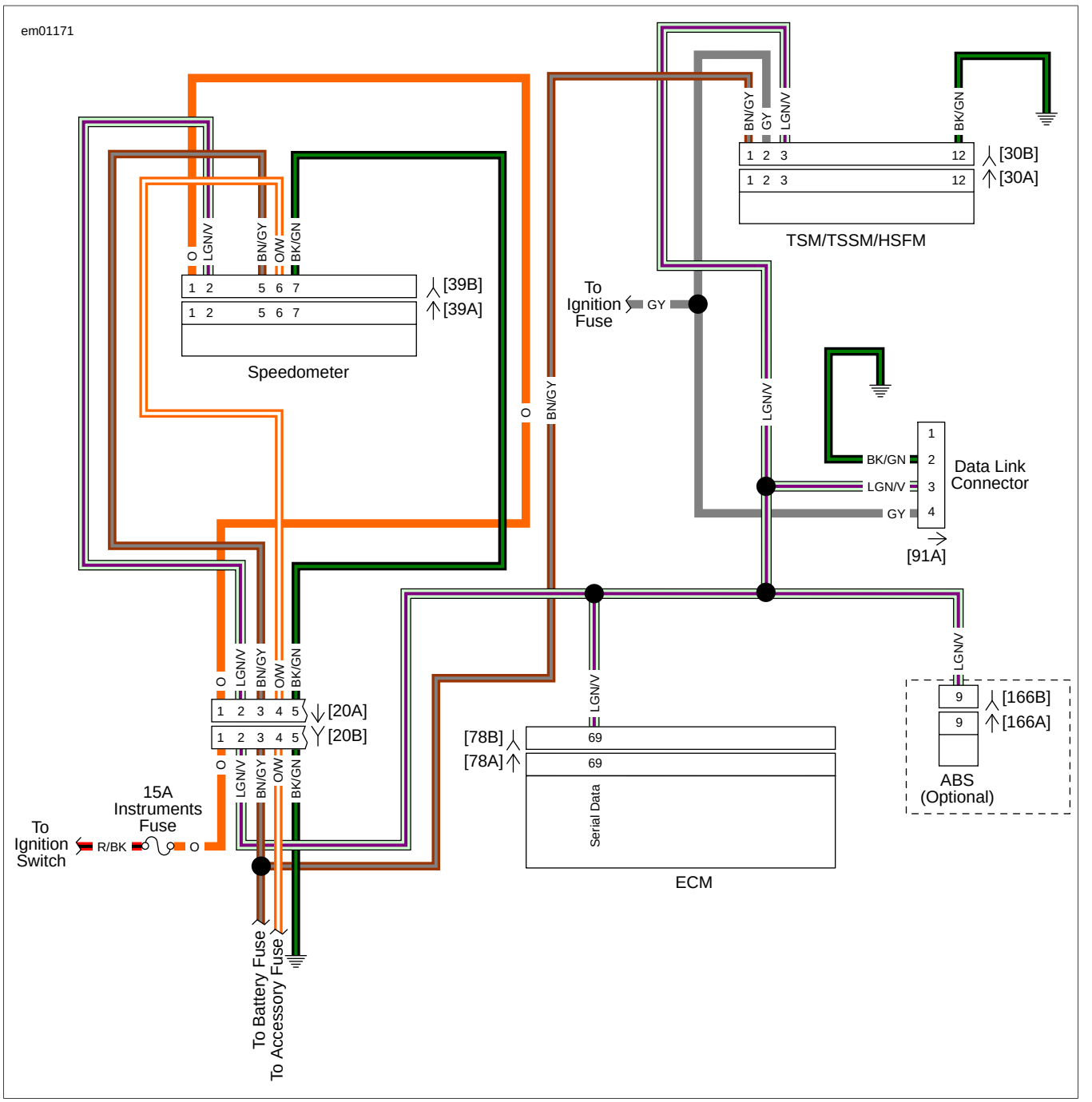


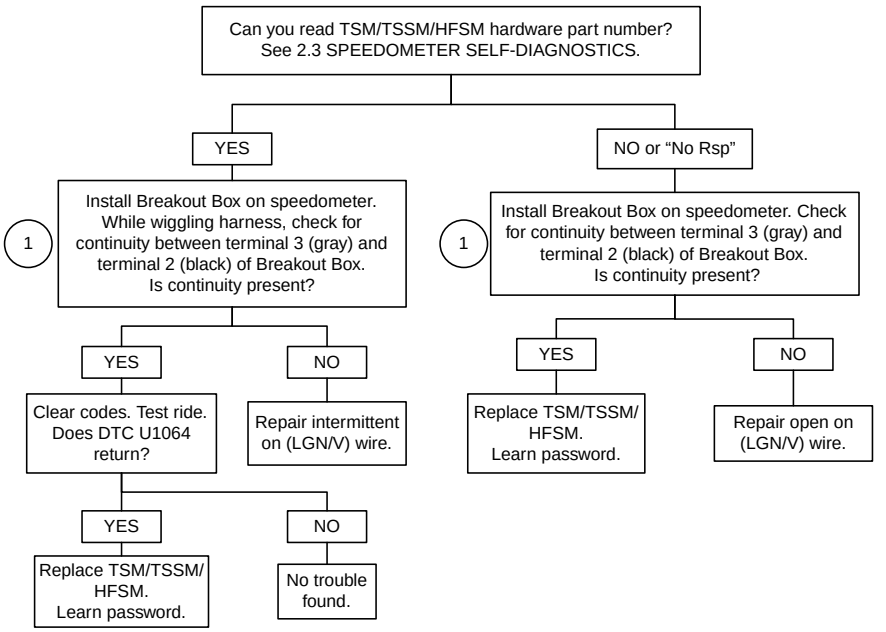
Figure 2-22. Serial Data Circuit: FLHR/C

Table 2-21. FLHR Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	16-place Molex	Under seat
[30]	TSM/TSSM/HFSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Packard	Back of speedometer (back of console)
[78]	ECM	73-place Packard	Under seat
[91]	DLC	4-place Deutsch	Under left side cover
[166]	ABS module	20-place Molex	Under right side cover

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTCs U1064 and U1255



Clear codes using speedometer self-diagnostics. See 2.3 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC U1300, U1301 OR BUS ER 2.14

GENERAL

Serial Data Low or Serial Data Open/High

The typical serial data voltage range is 0 Volt (inactive) to 7 Volts (active). Due to the short pulse, voltage is much lower on a DVOM. In analog mode, a DVOM reading serial data shows continuous voltage when active, typically 0.6-0.8 Volt. The range for acceptable operations is 0-7.0 Volts.

Table 2-22. Code Description

DTC	DESCRIPTION
U1300	Serial data low
U1301	Serial data open/high

DIAGNOSTICS

Diagnostic Tips

- If serial data is shorted, these DTCs automatically cause the check engine lamp to illuminate. The odometer reads BUS Er in this condition.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.
- If a U1300, U1301 or BUS Er is present, perform diagnostic procedures listed in 4.11 STARTS, THEN STALLS.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

TURN SIGNAL OVERVIEW 3.1

GENERAL

The TSM has two major functions:

- control turn signals.
- serve as BAS.

The optional, factory-installed, Harley-Davidson Smart Security System (**H-DSSS**) includes a HFSM, which provides the same functions as the TSM, but also includes security and immobilization functions.

SECURITY SYSTEM: JAPAN/KOREA

The security system on motorcycles sold in Japan and Korea meet the regulatory requirements for those countries. The system incorporates a TSSM. Complete details on operation, troubleshooting, and diagnostics are found in E.1 TSM/TSSM (JAPAN/KOREA) OVERVIEW.

TURN SIGNAL FUNCTIONS

- **Manual turn signal control:** Manual activation/deactivation of left and right turn signal flashing sequences.
- **Automatic turn signal cancellation:** Automatic cancellation of left and right turn signal flashing sequences based on either vehicle speed, vehicle acceleration or turn completion.
- **Hazard warning 4-way flashers:** Four-way left and right turn signal flashing capability.
- **Turn signal lamp diagnostics:** Self-diagnostics for short circuit and open lamp conditions on both left and right turn signal systems. See 3.9 CHECKING FOR DIAGNOSTIC TROUBLE CODES.

NOTE

The turn signals cannot be activated or deactivated when the ignition switch is in the ACC position. The turn signals can only be activated or deactivated with the ignition switch in the IGNITION position.

MANUAL CANCELLATION

To stop the turn signals from flashing, briefly press the turn signal switch a second time.

To switch turn direction signals, press the switch for the opposite turn signal. The first signal is cancelled and the opposite side begins flashing.

AUTOMATIC CANCELLATION

Press the left or right turn switch to activate automatic turn signal cancellation. There is no need to hold the turn switch in when approaching the turn. The TSM/HFSM will not cancel the signal before the turn is actually completed.

- When the directional switch is released, the system starts a 20 count. As long as the vehicle is traveling above 7 MPH (11.3 km/h) the directional always cancels after 20 flashes if the system does not recognize any other input.
- If the vehicle speed drops to 7 MPH (11.3 km/h) or less, including stopped, the directionals continue to flash. Counting resumes when vehicle speed reaches 8 MPH (12.9 km/h) and automatically cancels when the count total equals 20 as stated above.
- The turn signals cancel within two seconds upon turn completion. A sensor inside the TSM/HFSM cancels the signal after the vehicle has been returned to an upright position.

NOTE

The bank angle cancellation function has an automatic calibration feature. Ride the motorcycle for 0.25 miles (0.4 km) at steady speeds (upright) to calibrate the system. Performance of bank angle function may not be optimal until this calibration is performed. This self-calibration is performed automatically every time the vehicle is started and ridden.

BANK ANGLE FUNCTIONS

- **Emergency engine shutdown:** provides engine shutdown when vehicle is tipped over.
- **Emergency outputs disable:** disables turn signal lamps and starter motor when vehicle is tipped over.

BANK ANGLE RESTART

The engine shuts off automatically if the vehicle is tipped over. The turn signals, starter motor, ECM, fuel pump and coil will be disabled.

The odometer displays tIP when a tip over condition is detected.

To restart the motorcycle after shutdown has occurred:

1. Return the motorcycle to an upright position.
2. Cycle the ignition switch OFF-**IGNITION** before restarting the motorcycle.

CLUTCH/NEUTRAL INTERLOCK

- **Disables starter:** Disables starter until either the clutch lever is pulled in or transmission neutral is selected.
- **Diagnostics:** Provides diagnostics for clutch and neutral switch faults.

SECURITY SYSTEM H-DSSS

See 3.2 HARLEY-DAVIDSON SMART SECURITY SYSTEM.

HARLEY-DAVIDSON SMART SECURITY SYSTEM 3.2

COMPONENTS

The H-DSSS consists of three components:

- **Hands-Free Security Module:** See Figure 3-1. An electronic module that functions both as the TSM and as the HFSM.
- **Hands-Free Antenna:** See Figure 3-1. Mounted under the seat of the motorcycle.
- **Hands-Free Fob:** See Figure 3-2. A remote control device, intended to be carried by the rider whenever the vehicle is being operated.

NOTE

Do not relocate any of the security system components.



Figure 3-1. HFSM and Antenna



Figure 3-2. Hands-Free Fob w/Serial Number Label

SECURITY IMMOBILIZATION

The HFSM provides security and immobilization functions not found on the TSM. The HFSM disables the starter and ignition system. Additional functions include the ability to alternately flash the left and right turn signals and sound a siren (if equipped) if a theft attempt is detected.

NOTE

The siren must be in the chirp mode for the siren to chirp on arming or disarming. See 3.6 WARNINGS AND ALARMS, Siren Chirp Mode (Confirmation).

Conditions that activate the security system when system is armed include:

- **Detecting tampering of the ignition circuit:** Turn signals flash three times, optional siren chirps once and then turns off. If the tampering continues, a second warning activates after four seconds. Continued tampering causes the alarm to activate for 30 seconds and then turn off. The two warnings/alarm cycle is repeated for each tampering incident.
- **Detecting vehicle movement:** Turn signals flash three times, optional siren chirps once and then turns off. If the vehicle is not returned to its original position, a second warning activates after four seconds. If the vehicle is not returned to its original position, the alarm activates for 30 seconds then turns off. The two warnings/alarm cycle may repeat a maximum of 10 times with a 10 second pause between cycles.
- **Detecting that a battery or ground disconnect has occurred while armed:** Siren, if installed, activates its self-alarm mode. Turn signals will not flash.

See 3.5 ARMING/DISARMING SECURITY SYSTEM for more information.

NOTE

Disconnect the battery to prevent the siren (if installed) from activating within 5 seconds of turning the ignition switch to OFF/FORK LOCK. If the HFSM is armed, you must turn the ignition switch to IGNITION with a fob within range, again turn the ignition switch to OFF/FORK LOCK and remove the MAXIFUSE before the five-second arming period expires. With the MAXIFUSE removed, the battery can be disconnected.

HFSM FEATURES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The following information applies only to motorcycles equipped with the HFSM.

- **Security lamp:** See Figure 3-3. A lamp (key icon) within the speedometer face tells the rider if the system is armed or disarmed.
- **Personal code disarming:** If the fob is not available, the HFSM allows the rider to disable the security alarm and immobilization functions with a five-digit personal code.
- **Arming confirmation:** When the HFSM is armed, the system provides visual feedback (confirmation) to the rider by flashing the turn signals and an audible chirp if equipped with the optional smart siren and chirp mode is enabled.
- **Disarming confirmation:** When the HFSM is disarmed, the system provides an audible chirp (confirmation) if equipped with the optional smart siren and chirp mode is enabled.
- **Transport mode:** It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be moved in an immobilized state.
- **Starter/ignition disable:** When armed the starter and ignition system are disabled.
- **Security system alarm:** See Figure 3-4. The system alternately flashes the left and right turn signals and sounds an optional smart siren if a vehicle security condition is detected while the system is armed.
- **Dealer service mode:** This mode allows the dealer to disable security system using DIGITAL TECHNICIAN II (Part No. HD-48650). Dealer service mode is exited when module detects an assigned fob in range.

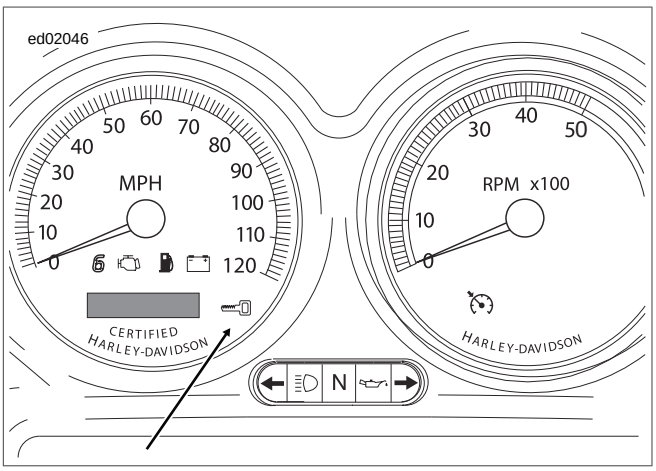


Figure 3-3. Security Lamp (Key Icon - Typical)

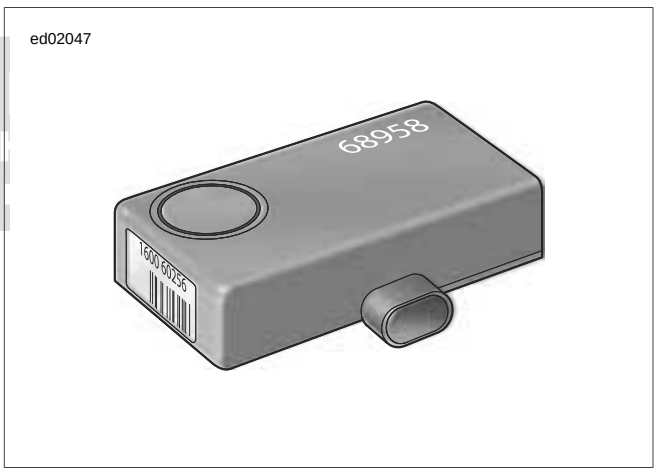


Figure 3-4. Security Siren

H-DSSS ACTUATION 3.3

GENERAL

Setting up a vehicle TSM/HFSM depends on whether the vehicle has a TSM or the optional HFSM security system installed.

SIDECAR CONFIGURATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

All motorcycles ship with the H-DSSS set for use **without** a sidecar installed. If a motorcycle is equipped with a TSM, no further actuation is required. If motorcycle is to be used with a sidecar, a remote BAS needs to be installed and properly configured using DIGITAL TECHNICIAN II (Part No. HD-48650).

ACTUATION

Actuation consists of assigning two fobs to the system, and entering an initial PIN. The PIN can be changed by the rider at any time.

1. Configure HFSM motorcycles by assigning **both** fobs to the vehicle.
2. Configure HFSM motorcycles by entering a PIN picked by the owner. The personal code allows the owner to operate the system if the fob is lost or inoperable. Record the PIN in the Owner's Manual and instruct the customer to carry a copy (use the wallet card found in the Owner's Manual). See 3.4 PERSONAL IDENTIFICATION NUMBER (PIN).

Once the system has been activated, it always arms within 5 seconds of turning the ignition switch to **OFF** and no motorcycle motion.

FOB ASSIGNMENT

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Use DIGITAL TECHNICIAN II (Part No. HD-48650) to assign both fobs to the H-DSSS. Follow the menu prompts in the DIGITAL TECHNICIAN II (Part No. HD-48650) display and scan the fob serial number with the bar code reader, or key-in the number from the keyboard. See a Harley-Davidson dealer.

NOTE

Each fob has a unique serial number. The label should be removed from the fob and attached to a blank NOTES page in the Owner's Manual for reference.

POWER DISRUPTION AND CONFIGURING

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

The HFSM will not enter PIN entry mode on the first attempt after battery voltage has been removed from terminal 1. This occurs after any of the following:

- battery disconnect or power drain.
- battery fuse removal.
- connecting BREAKOUT BOX (Part No. HD-42682) to HFSM connector.

Therefore, after all battery reconnects, modify the configuration sequence as follows:

1. Set engine stop switch to **OFF**, cycle ignition switch IGNITION-OFF-IGNITION-OFF-IGNITION and press left turn signal switch **twice**.
2. Repeat steps listed above.
3. Continue with PIN entry sequence listed.

PERSONAL IDENTIFICATION NUMBER (PIN) 3.4

GENERAL

The PIN consists of five digits. Each digit can be any number from 1 through 9. There can be no zeros (0) in the PIN. Use the PIN to disarm the security system in case the fob becomes unavailable.

INITIAL PIN ENTRY

To enter a PIN on a motorcycle with no PIN previously installed during HFSM actuation, refer to Table 3-1.

Table 3-1. Entering an Initial PIN: HFSM

STEP	ACTION	CONFIRMATION
1	Select a five-digit (1 through 9) initial PIN and record in the Owner's Manual and on the wallet card.	
2	With an assigned fob present, set engine stop switch to **OFF.**	
3	Cycle ignition switch **IGNITION**-OFF-**IGNITION**-OFF-**IGNITION.**	
4	Press **left** turn signal button twice.	Turn signals flash three times.
5	Press **right** turn signal button once.	Five dashes appear in the odometer window. The first dash flashes.
6	Enter first digit (a) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
7	Press **right** turn signal button once.	The digit (a) replaces the dash in the odometer. The second dash flashes.
8	Enter second digit (b) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
9	Press **right** turn signal button once.	The digit (b) replaces the dash in the odometer. The third dash flashes.
10	Enter third digit (c) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
11	Press **right** turn signal button once.	The digit (c) replaces the dash in the odometer. The fourth dash flashes.
12	Enter fourth digit (d) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
13	Press **right** turn signal button once.	The digit (d) replaces the dash in the odometer. The fifth dash flashes.
14	Enter fifth digit (e) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
15	Press **right** turn signal button once.	The digit (e) replaces the dash in the odometer. The first digit flashes.
16	Turn the ignition switch to **OFF.**	

CHANGING THE PIN

To change a PIN, refer to Table 3-2. The rider can change the PIN at any time.

Modifying an Existing Pin

If a PIN was previously entered, the odometer displays the equivalent digit. Each additional press of the left turn switch increments the digit.

Examples:

- To advance from 5 to 6, press and release the left turn switch once.
- To advance from 8 to 2, press and release the left turn switch three times (9-1-2).

Table 3-2. Changing the PIN: HFSM

STEP	ACTION	CONFIRMATION	NOTES
1	Select a five-digit (1 through 9) PIN and record in the Owner's Manual and on the wallet card.		
2	With fobs present, cycle ignition switch IGNITION-OFF-IGNITION-OFF-IGNITION.		
3	Press **left** turn signal button twice.	Turn signals flash 3 times.	
4	Press **right** turn signal button once.	Current PIN will appear in odometer. The first digit will flash.	
5	Enter first digit (a) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
6	Press **right** turn signal button once.	The new digit replaces the current in the odometer. The second digit flashes.	
7	Enter second digit (b) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
8	Press **right** turn signal button once.	The new digit replaces the current in the odometer. The third digit flashes.	
9	Enter third digit (c) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
10	Press **right** turn signal button once.	The new digit replaces the dash in the odometer. The fourth digit flashes.	
11	Enter fourth digit (d) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
12	Press **right** turn signal button once.	The new digit replaces the current in the odometer. The fifth digit flashes.	
13	Enter fifth digit (e) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
14	Press **right** turn signal button once.	The new digit replaces the current in the odometer. The first digit flashes.	
15	Turn the ignition switch to **OFF.**		Turning ignition switch to OFF stores PIN.

DIGITAL TECHNICIAN II

ARMING/DISARMING SECURITY SYSTEM 3.5

HANDS-FREE FOB

See Figure 3-5. The HFSMs reception range for the hands-free fob signal depends on a specific receiver pattern. The range is an arm's length.

NOTES

- *Environmental and geographic conditions may affect signal range.*
- *Always have the fob present whenever the motorcycle is operated.*
- *Do not place fob in metal enclosure, and do not place it closer than 3.0 in. (80.0 mm) to the hands-free antenna, cellular phones, PDAs, displays and other electronic devices while operating the motorcycle. That may prevent the fob from disarming the security system.*
- *Replace the fob battery every year. See 3.27 HFSM MAINTENANCE.*



Figure 3-5. Hands-Free Fob

SECURITY LAMP (KEY ICON)

See Figure 3-6. The security lamp (key icon) in the speedometer face provides feedback to the rider confirming armed or disarmed status. Refer to Table 3-3.

Table 3-3. Security Lamp Status

LAMP	MODE
Does not flash.	No security system (TSM only), security system not armed.
Flashes every second.	Two minute timeout after failed PIN entry attempt or a battery reconnect has occurred while armed.
Flashes every 2.5 seconds.	Security system armed.
Flashes 4 times a second.	PIN entry mode.
Stays on solid with ignition switch off.	Arming is starting up. You have 5 seconds before system is armed.
Stays on solid with ignition switch on.	If solid for more than 4 seconds after ignition switch is turned to IGNITION, a current DTC is present.

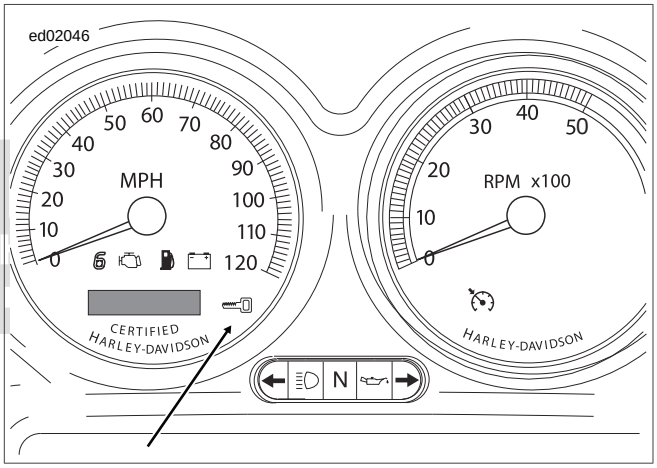


Figure 3-6. Security Lamp (Key Icon - Typical)

ARMING

The H-DSSS automatically arms within five seconds when the motorcycle is parked, ignition switch is turned to **OFF**, and motion is not detected.

Confirmation: On arming, the turn signals flash twice and the security siren chirps twice if chirp function is activated. While armed, the security lamp (key icon) flashes every 2.5 seconds. Refer to Table 3-3.

DISARMING

There are two ways to disarm the H-DSSS:

- automatic disarming.
- disarming with a PIN.

Automatic Disarming

Always have the fob present when riding, loading, fueling, moving, parking or servicing the motorcycle. Carry the fob in a convenient pocket. The H-DSSS disarms automatically when

the ignition switch is turned to IGNITION. On disarming, the security siren chirps once (if chirp function is activated) and the security lamp (key icon) turns on solid for four seconds then goes out. Refer to Table 3-4.

Disarming with a Personal Identification Number (PIN)

See 3.4 PERSONAL IDENTIFICATION NUMBER (PIN) to enter an initial PIN to actuate the system.

If you make an error while disarming the HFSM using the PIN, the alarm activates for 30 seconds after the last digit is entered. After a failed attempt, the security lamp flashes once every second for two minutes. **During this time, the vehicle will not accept any attempt to enter a PIN.** Refer to Table 3-4.

Table 3-4. Entering the PIN to Disarm HFSM (Example: 3-1-3-1-3)

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set engine stop switch to **OFF.**		
2	Turn ignition switch to **IGNITION.**		
3	Hold **both** turn switches in until confirmation. *	Security lamp blinks at fast rate and "0- - - - " is displayed in the odometer. The first digit flashes.	System is ready for PIN entry.
4	Enter first digit of code (3) by pressing **left** turn switch three times.		
5	Press right turn switch once.	The first digit will be displayed and the next dash will flash in the odometer.	Serves as enter key.
6	Enter second digit of code (1) by pressing **left** turn switch once.		
7	Press **right** turn switch once.	The first two digits are displayed and the next dash flashes in the odometer.	Serves as enter key.
8	Enter third digit of code (3) by pressing **left** turn switch three times.		
9	Press **right** turn switch once.	The first three digits are displayed and the next dash flashes in the odometer.	Serves as enter key.
10	Enter fourth digit of code (1) by pressing **left** turn switch **1** time.		
11	Press **right** turn switch once.	The first four digits are displayed and the next dash flashes in the odometer.	Serves as enter key.
12	Enter fifth digit of code (3) by pressing **left** turn switch three times.		
13	Press **right** turn switch once.	Security lamp stops blinking and the odometer displays miles.	System is disarmed.
* This must be done within two seconds of turning the ignition switch to IGNITION. If system issues a warning before the security system flashes at a fast rate, then cycle ignition switch OFF until security key icon flashes at 2.5 second rate before re-attempting PIN entry.			

DIGITAL HARLEY-DAVIDSON

WARNINGS AND ALARMS 3.6

WARNINGS

A warning consists of three alternate flashes of the turn signals and chirp from the optional security siren. Warnings are issued from an armed HFSM in the following order:

1. **First Warning:** A warning is issued whenever a person without a fob present attempts to move the motorcycle or turns the ignition switch to **IGNITION.**
2. **Second Warning:** If the motion continues or the ignition switch is not turned back to **OFF**, a second warning is issued within four seconds of the first.
3. **Alarm:** If the motion continues or the ignition switch is not turned to **OFF** past the second warning, the H-DSSS goes into full alarm.

ALARM

Activation

In the full alarm state, the turn signals flash alternately, and if equipped with the security siren, the siren sounds.

After 30 seconds of alarm, if no further motorcycle motion is detected, the alarm stops.

NOTE

*Motorcycle must be returned to original parked position with ignition switch turned to **OFF**.*

If motorcycle motion continues, the alarm starts again and continues for another 30 seconds.

The HFSM repeats the alarm cycles 10 times for a total of five minutes, with a 10-second pause between alarm cycles.

NOTES

- *During warnings and alarms, the starter motor and the ignition remain disabled.*
- *The alarm also activates the LED and vibration or audible modes of a Harley-Davidson security pager. A pager can operate either in silent or in combination with an optional smart siren. The range of the pager can be up to 0.50 mi (0.89 km).*

Deactivation

The alarm cycles can be discontinued at any time by moving an assigned fob to the motorcycle. The presence of the fob terminates the alarm.

SIREN CHIRP MODE (CONFIRMATION)

Chirpless Mode

In the chirpless mode, the siren does not chirp on arming or disarming.

NOTE

Even when armed in the chirpless mode, the siren still chirps warnings on movement and activates the alarm through cycles.

Chirp Mode

On arming in the chirp mode, the siren responds with two chirps. When disarming, the siren responds with a single chirp.

Switching Modes

Cycling quickly through two armings and disarmings switches the system from either the chirpless mode or the chirp mode to its opposite.

1. With the fob present, the ignition switch to IGNITION and the system disarmed, turn the ignition switch off.
2. When the system arms (two flashes of turn signals), immediately turn the ignition switch to IGNITION.
3. Wait until the security lamp goes out, then immediately turn the ignition switch off.
4. When the system arms (two flashes of turn signals), immediately turn the ignition switch to IGNITION and wait for system to disarm.

Sidecar Equipped Motorcycles

When installing a sidecar onto motorcycle use SIREN (No. 68958-00).

NOTE

Use of the earlier siren will not allow the user to toggle from "chirp" to "chirpless". Whenever the system is armed, the user will receive a feedback "chirp". On sidecar equipped motorcycles, the security system must be disarmed with transmission in gear.

SERVICE/EMERGENCY FUNCTIONS 3.7

TRANSPORT MODE

It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be picked up and moved in an armed state, however, any attempt to start the engine triggers the alarm.

Entering Transport Mode

1. Turn the ignition switch to IGNITION.
2. Set the engine stop switch to OFF.
3. With an assigned fob within range, turn the ignition switch from IGNITION to ACCESS.
4. Simultaneously press both the left and the right turn signal switches. This must be done within five seconds of turning the ignition switch to ACCESS.
5. After the turn signals flash once, turn the ignition switch to OFF and the module is armed.
6. Confirmation: Turn signal blinks three times when armed for one ignition cycle.

Exiting Transport Mode

Return the system to normal operation:

1. With the fob present, turn the ignition switch to IGNITION to disarm the HFSM. To cancel the transport mode, set the engine stop switch to RUN.

SERVICE MODE

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

With a fob present, the HFSM can be configured for service by disabling the security system with DIGITAL TECHNICIAN II (Part No. HD-48650).

Once disabled, the motorcycle can be operated without an assigned fob present. To maintain the service mode, the assigned fobs must be kept out of range. If the fob appears in range, the service mode is exited.

FOUR-WAY FLASHING

If it is necessary to leave a motorcycle parked along side the road, the hazard warning four-way flashers can be turned ON with the H-DSSS armed.

Arming the HFSM with the Hazard Warning Flashers On

1. Turn the ignition switch to IGNITION.
2. Simultaneously press both left and right turn signal switches to turn the four-way flashers on. The four-way flashers will continue for two hours.
3. Turn the ignition switch to OFF to arm the H-DSSS.

Disarming the HFSM and Turn the Hazard Warning Flashers Off

1. With a fob present, turn the ignition switch to IGNITION.
2. Simultaneously press the left and right turn signal switches.

TROUBLESHOOTING 3.8

TURN SIGNALS (TSM/HFSM)

Verify the operation of the turn signals and the integrity of the fuse protecting the turn signals before further troubleshooting.

SECURITY SYSTEM (HFSM)

If the fob is present, and the security system is issuing warnings or alarm when the motorcycle is moved, the reason may be one of the following:

1. Strong electromagnetic interference in the area you have parked.
 a. Verify you have not placed your fob in a metal enclosure, or within 3.0 in. (80.0 mm) of other electronic devices.
 b. Place fob next to motorcycle and turn the ignition switch to IGNITION. After the system disarms, place the fob back in its carrying location.
 c. Try moving the motorcycle approximately 15 feet (4.57 m) away from the current parking spot.
2. The fob battery is dead. Use PIN to disarm the vehicle. Replace fob battery.
3. Fob is damaged. Use PIN to disarm the vehicle. Replace the fob.

NOTES

- *If your security icon is staying solid on while you are riding the vehicle, take your vehicle to your dealer as soon as practical.*
- *Always lock the fork and take the ignition key with you for added protection.*

DIAGNOSTICS MODE

The TSM/HFSM measures the current when the turn signals are used. If there is a burned out light bulb on one side, the remaining light and the corresponding turn signal indicator flash at double the normal rate starting with the fifth flash.

Other diagnostic conditions monitored include:

- short circuit in the turn signal wiring
- open circuit in the turn signal wiring
- stuck turn signal switch

NOTES

- *A stuck turn signal switch disables the automatic turn signal cancellation feature.*
- *If a stuck switch is detected, hold the left and right turn signal switches in for more than one second to activate the four-way flashers.*

See 3.9 CHECKING FOR DIAGNOSTIC TROUBLE CODES for more information.

TROUBLESHOOTING

To resolve TSM/HFSM faults, follow three basic steps:

1. Retrieve DTCs using speedometer self-diagnostics. See 3.11 SPEEDOMETER SELF-DIAGNOSTICS.
2. Diagnose system problems. This involves using special tools and the diagnostic flowcharts in this section.
3. Correct problems through the replacement and/or repair of the affected components.

After repairs are performed, validate the work. This involves clearing the DTCs and confirming proper vehicle operation as indicated by the behavior of the turn signals.

CHECKING FOR DIAGNOSTIC TROUBLE CODES 3.9

GENERAL

Problems fall into at least one of the following categories:

- turn signal malfunction
- bank angle (engine disable)
- clutch/neutral interlock (starter enable)
- security lamp problem
- security system malfunction

SECURITY LAMP DIAGNOSTICS

To diagnose system problems, start by observing the behavior of the security lamp.

NOTES

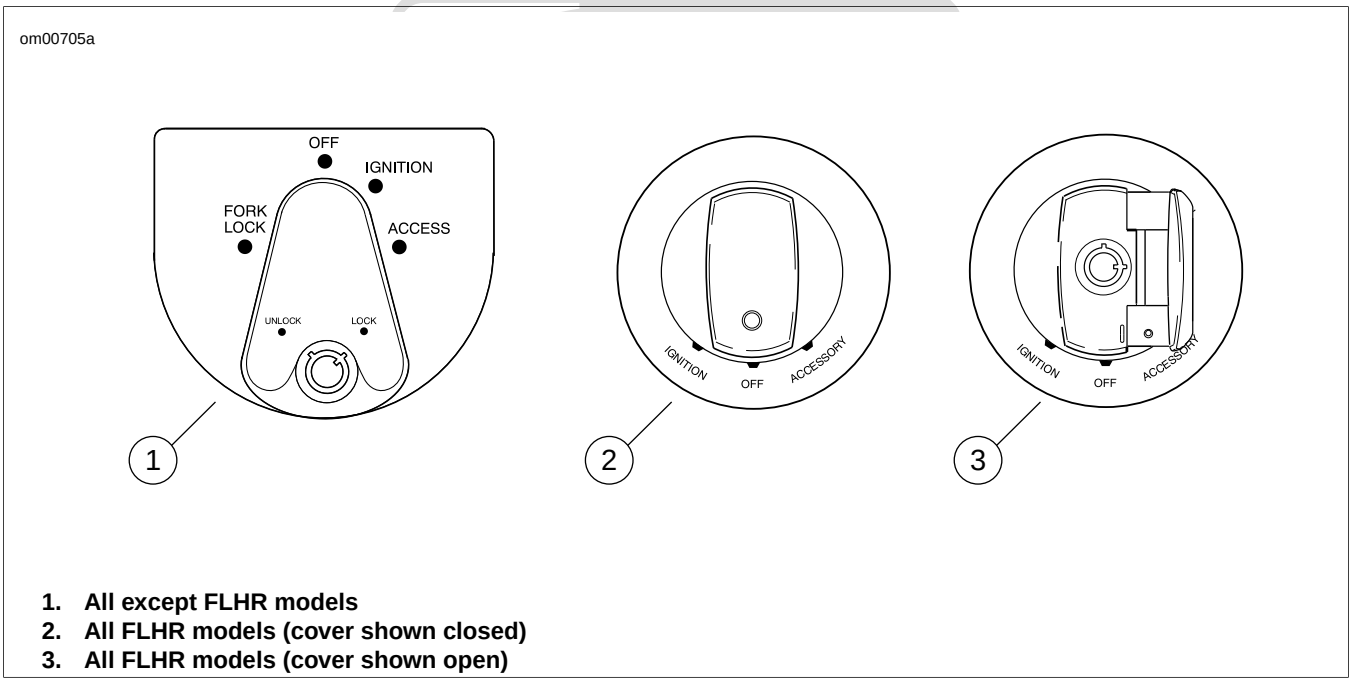
- *See Figure 3-7. Key ON means the ignition switch is turned to IGNITION and the engine stop switch is set to RUN (although the engine is **not** running).*
- *See Figure 3-8. When the ignition switch is turned to IGNITION, the security lamp will illuminate for approximately four seconds and then turn off.*
- *If the security lamp is not illuminated at key on or if it fails to turn off after the initial four-second period, the speedometer may need to be replaced. See 3.11 SPEEDOMETER SELF-DIAGNOSTICS. If "BUS Er" is displayed on the odometer, it may take up to 20 seconds for the security lamp to illuminate.*
- *The security lamp also lights for eight seconds after the bulb check if historic DTCs are present. The security lamp stays on if current DTCs are set. If a historic DTC is present, the security lamp lights for two ignition cycles or until the DTC is cleared manually.*

See Figure 3-9. After the lamp turns off after being illuminated for the first four-second period, one of three events may occur:

- The lamp remains off. This indicates there are no current fault conditions or stored historic DTCs currently detected by the HFSM.
- The lamp stays off for only four seconds and then comes back on for an eight-second period. This indicates a historic DTC is stored, but no current DTC exists.
- The lamp remains on beyond the eight-second period. This indicates a current DTC exists.

NOTE

See 3.9 CHECKING FOR DIAGNOSTIC TROUBLE CODES, Code Types for a complete description of DTC formats.



1. **All except FLHR models**
2. **All FLHR models (cover shown closed)**
3. **All FLHR models (cover shown open)**

Figure 3-7. Ignition Switch: Touring Models

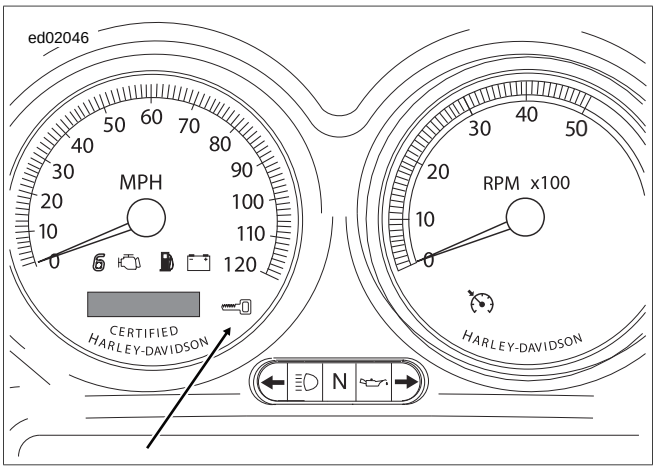


Figure 3-8. Security Lamp (Key Icon - Typical)

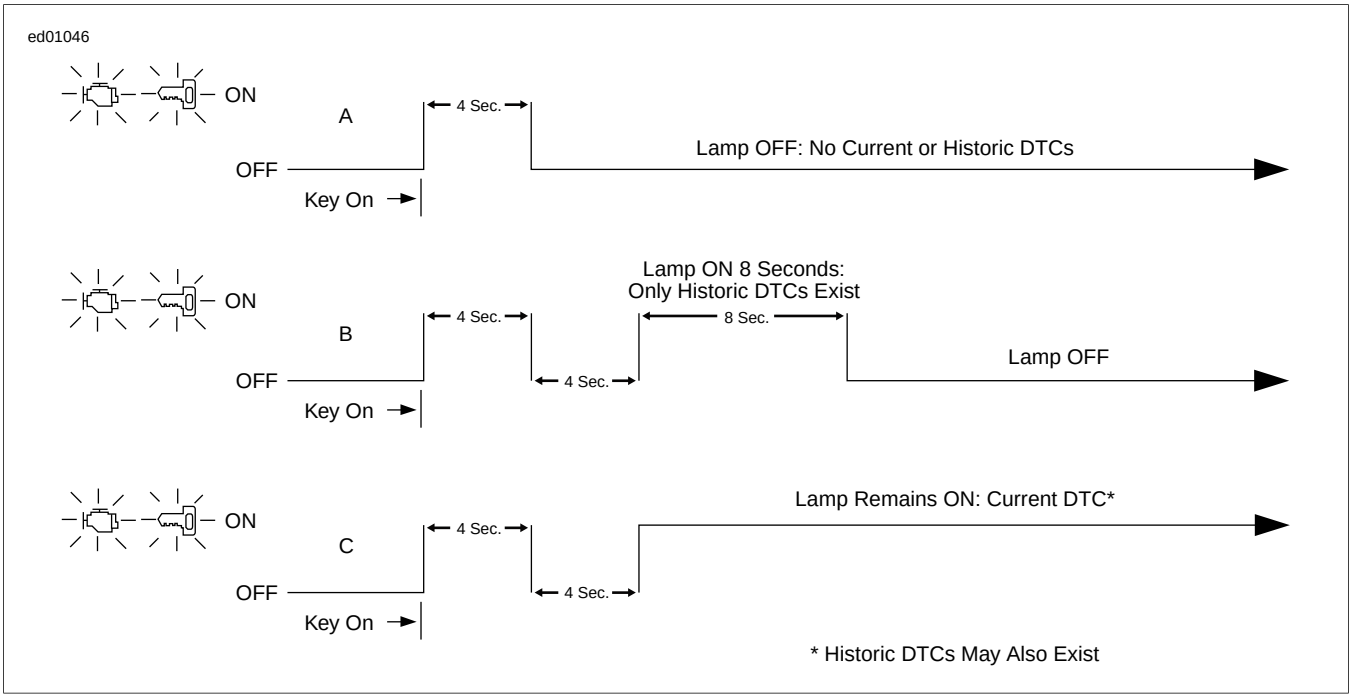


Figure 3-9. Security Lamp Operation

CODE TYPES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

There are two types of DTCs:

- current
- historic

If a DTC is stored, it can be read using either a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650) or speedometer self-diagnostics. See 3.11 SPEEDOMETER SELF-DIAGNOSTICS.

NOTES

- *Speedometer self-diagnostics displays both current and historic DTCs. To differentiate between current and historic DTCs, use a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650).*
- *All DTCs reside in the memory of the ECM, TSM/HFSM, speedometer, or tachometer until the DTC is cleared by use of the speedometer self-diagnostics. See 3.11 SPEEDOMETER SELF-DIAGNOSTICS.*
- *A historic DTC is also cleared after a total of 50 ignition cycles has elapsed. After the 50 ignition cycle retention period, the DTC is automatically erased from memory providing that no subsequent faults of the same type are detected in that period.*

Current

Current DTCs are those which are present during the current ignition cycle. See the appropriate flowcharts for solutions.

Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic DTC rather than a current DTC. For example, intermittent output shorts can become typical historic DTCs.

Historic DTCs can only be retrieved using DIGITAL TECHNICIAN II (Part No. HD-48650).

Historic DTCs are stored for 50 ignition cycles after any DTC was last set as current to assist in the diagnosis of intermittent faults. On the 50th cycle, the DTC clears itself. The security lamp only indicates the existence of historic DTCs for two ignition cycles.

It is important to note that historic DTCs exist whenever the system indicates the existence of a current fault. See Multiple DTCs/Priority Ranking if multiple DTCs are found.

Diagnostic charts are designed for use with current DTCs and as a result they frequently suggest part replacement. When diagnosing a historic DTC, the charts can be helpful, but should not lead to part replacement without verification the part is faulty.

RETRIEVING DTCS

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The TSM/HFSM supports two levels of diagnostics.

- The most sophisticated mode employs a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650).
- The second mode requires using the speedometer self-diagnostics. Speedometer, tachometer (if equipped), TSM/HFSM and ECM DTCs can be accessed and cleared. See 3.11 SPEEDOMETER SELF-DIAGNOSTICS.

MULTIPLE DTCS/PRIORITY ORDER

While it is possible for more than one fault to occur and set more than one DTC, there are several conditions which may result in **one** fault setting multiple DTCs:

Serial data DTCs U1016, U1255, U1300 and U1301 may be accompanied by other DTCs. Always correct the serial data DTCs before resolving the other DTCs.

Refer to Table 3-5. This table lists the DTCs in priority order. Correct DTCs in priority order.

Table 3-5. TSM/HFSM DTCs and Fault Conditions

PRIORITY	DTC	FAULT CONDITION	DIAGNOSTICS
1	U1300	Serial Data Low	3.25 DTC U1300, U1301 OR BUS ER
2	U1301	Serial Data High	3.25 DTC U1300, U1301 OR BUS ER
3	U1016	Loss of ECM Serial Data	3.24 DTC U1016
4	U1255	Serial Data Error	3.24 DTC U1016
5	B1142	Smart Security System Internal fault	3.19 DTC B1136, B1142 (HFSM ONLY)
6	B1135	Accelerometer Failed	3.18 DTC B1135
7	B1136 (HFSM)	Accelerometer Tip Test Error	3.19 DTC B1136, B1142 (HFSM ONLY)
8	B1151	Bank Angle Sensor (BAS) Short to Ground	3.22 DTC B1151, B1152, B1153
9	B1152	Bank Angle Sensor (BAS) Short to Battery	3.22 DTC B1151, B1152, B1153
10	B1153	Bank Angle Sensor (BAS) High	3.22 DTC B1151, B1152, B1153
NOTE Sidecar DTCs apply only to Touring models equipped with sidecars. If DTCs B1151, B1152 and/or B1153 are present on non-sidecar-equipped motorcycles, the TSM/TSSM/HFSM is not properly configured.			
11	B1154	Clutch Switch Input Short to Ground	3.23 DTC B1154, B1155
12	B1155	Neutral Switch Input Short to Battery	3.23 DTC B1154, B1155
13	B1134	Starter Output High	3.17 DTC B1134
14	B1121 (TSM)	Left Turn Output Fault	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS
	B1121 (HFSM)	Left Turn Output Open	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS
15	B1122 (TSM)	Right Turn Output Fault	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS
	B1122 (HFSM)	Right Turn Output Open	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS
16	B1123 (HFSM)	Left Turn Output Short to Ground	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS

Table 3-5. TSM/HFSM DTCs and Fault Conditions

PRIORITY	DTC	FAULT CONDITION	DIAGNOSTICS
17	B1124 (HFSM)	Right Turn Output Short to Ground	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS
18	B1125 (HFSM)	Left Turn Output Short to Battery	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS
19	B1126 (HFSM)	Right Turn Output Short to Battery	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS
20	B1143 (HFSM)	Security Antenna Short to Ground	3.21 DTC B1143, B1144, B1145 (HFSM ONLY)
21	B1144 (HFSM)	Security Antenna Short to Battery	3.21 DTC B1143, B1144, B1145 (HFSM ONLY)
22	B1145 (HFSM)	Security Antenna Open	3.21 DTC B1143, B1144, B1145 (HFSM ONLY)
23	B0563	Battery Voltage High	3.14 DTC B0563
24	B1131 (HFSM)	Alarm Output Low	3.16 DTC B1131, B1132 (HFSM ONLY)
25	B1132 (HFSM)	Alarm Output High	3.16 DTC B1131, B1132 (HFSM ONLY)
26	B1141 (TSM)	Ignition Switch Low/Open	3.21 DTC B1143, B1144, B1145 (HFSM ONLY)
	B1141 (HFSM)	Ignition Switch Low/Open	3.20 DTC B1141 (HFSM ONLY)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

INITIAL DIAGNOSTIC CHECK: TSM/HFSM 3.10

GENERAL

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-48650	DIGITAL TECHNICIAN II

To locate faulty circuits or other system problems, follow the diagnostic flowcharts. For a systematic approach, always begin with initial diagnostics. Read the general information and then work your way through the flowchart box by box.

Diagnostic Notes

If a numbered circle appears adjacent to a flowchart box, then more information is offered in the diagnostic notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual where information on the location and removal of components may be obtained.

Circuit Diagram/Wire Harness Connector Table

When working through a flowchart, refer to the illustrations, the associated circuit diagram and the wire harness connector table as necessary. The wire harness connector table for each circuit diagram identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a BREAKOUT BOX (Part No. HD-42682) and a DVOM are required. See 3.12 BREAKOUT BOX: TSM/HFSM.

To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Job/Time Codes

Some charts may contain warranty job/time codes. Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

Reprogramming ECM

Diagnostic charts frequently suggest ECM replacement. In the event an ECM needs to be replaced, it must be reprogrammed using DIGITAL TECHNICIAN II (Part No. HD-48650). See your dealer. Perform a password learn procedure. See 3.26 TSM/HFSM: PASSWORD LEARN.

INITIAL DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Tips

- If odometer reads "BUS Er" with the ignition switch turned to IGNITION (engine stop switch at RUN with the engine off), check data bus for an open or short to ground between data link connector [91A] terminal 3 and ECM connector [78B] terminal 69, HFSM connector [30B] terminal 3, speedometer connector [39B] terminal 2, radio connector [27] terminal 9 (if equipped), ABS connector [166] terminal 9 (if equipped), or tachometer (if equipped) connector [108B] terminal 2.
- Check for an open diagnostic test terminal between data link connector [91A] terminal 3 and TSM/HFSM connector [30B] terminal 3. With ignition switch turned to IGNITION, serial data bus voltage should be 0.6-0.8 Volt. The range of acceptable voltage is 0-7.0 Volts.
- To identify intermittents, wiggle wire harness while performing steps in the diagnostic check charts.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness connector [39B] and speedometer connector [39A] using INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601). See 2.5 BREAKOUT BOX: SPEEDOMETER/TACHOMETER.
2. Compare TSM/HFSM system behavior to symptoms in Table 3-6.

Table 3-6. Symptoms That May Not Set DTCs

SYMPTOM	START WITH FLOWCHART
HFSM: Fails to disarm	HFSM: Fails to Disarm
TSM/HFSM: Turn signal will not cancel	Will Not Cancel On Turn Completion
TSM/HFSM: Turn signal cancels erratically	Cancels Erratically
TSM/HFSM: Turn signal flashes double normal rate, all bulbs good	TSM/HFSM Turn Signal Error 3A: Turn Signals Flash at Double Normal Rate, All Bulbs Work
TSM: Turn signals will not flash	DTCs B1121, B1122, and B1141, Will Not Flash, 4-Way Flashers Inoperable (Part 1 of 4)
HFSM: Symptom - Will not flash. No DTCs or DTC B1141	DTC B1141, Will Not Flash, No Codes (Part 1 of 2)

Other Diagnostic Trouble Codes (DTCs)

See 2.5 BREAKOUT BOX: SPEEDOMETER/TACHOMETER for any DTCs related to the speedometer.

See 4.5 INITIAL DIAGNOSTIC CHECK: EFI for any DTCs related to the ECM.

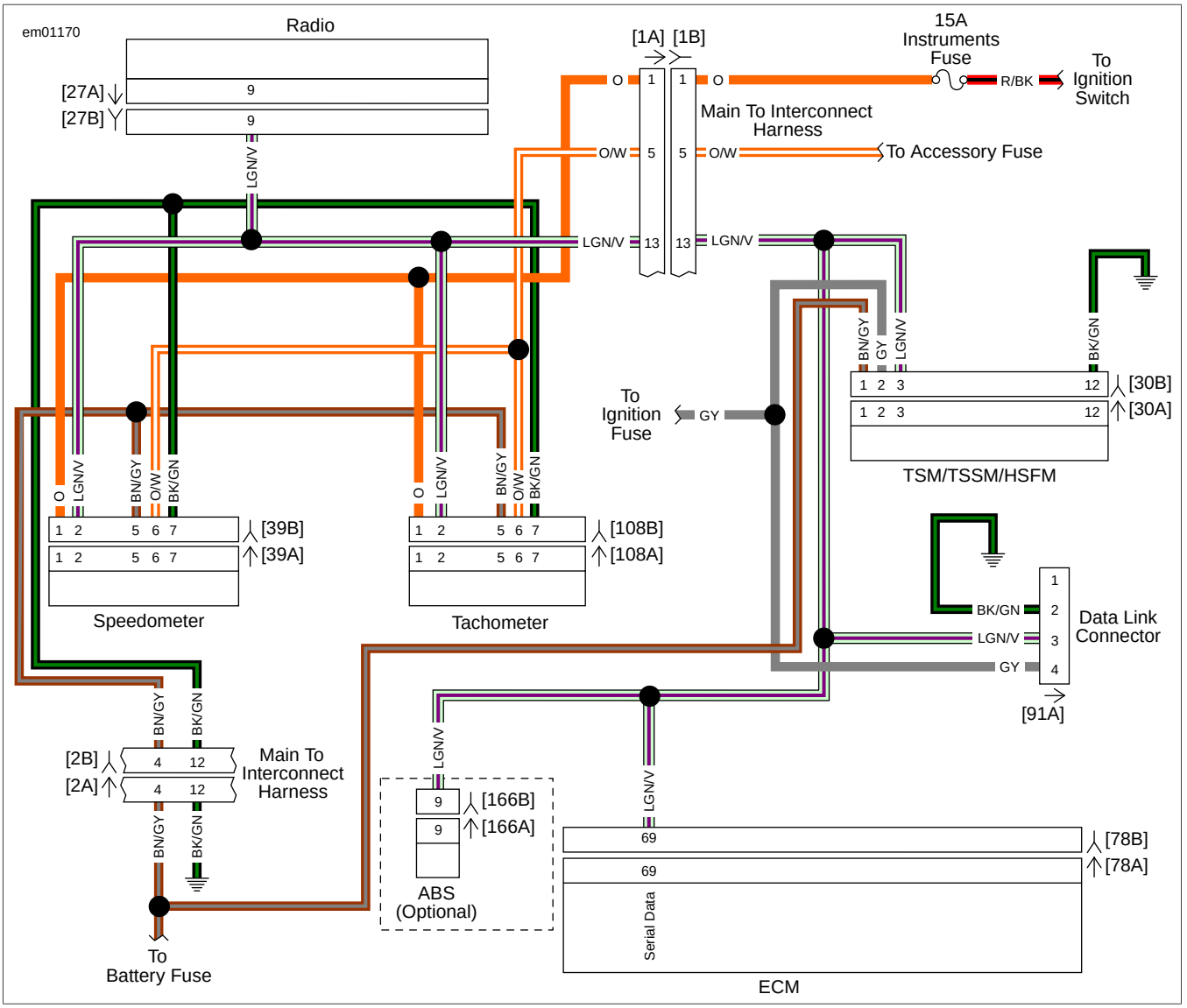


Figure 3-10. Initial Diagnostic Check (FLHX, FLHT/C/U, FLTR)

Table 3-7. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side below radio
[2]	Main to interconnect harness	All	12-place Molex (Gray)	Inner fairing - left radio support bracket
[27]	Radio	All	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[30]	TSM/TSSM/HFSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHT/C	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
[78]	ECM	All	73-place Packard	Under seat

Table 3-7. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[91]	DLC	All	4-place Deutsch	Under left side cover
[108]	Tachometer	FLHT/C	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)
[166]	ABS module	All	20-place Molex	Under right side cover

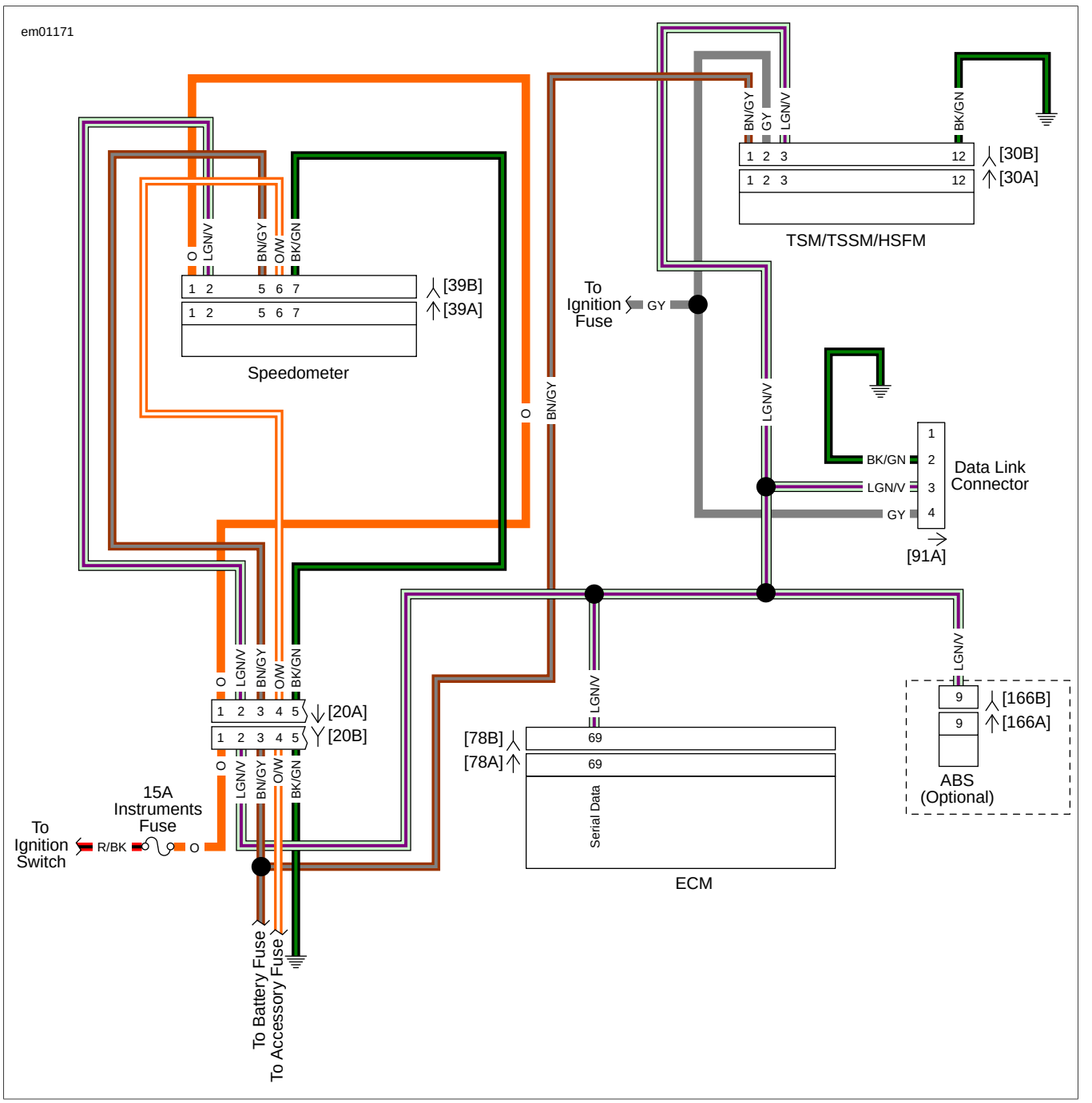


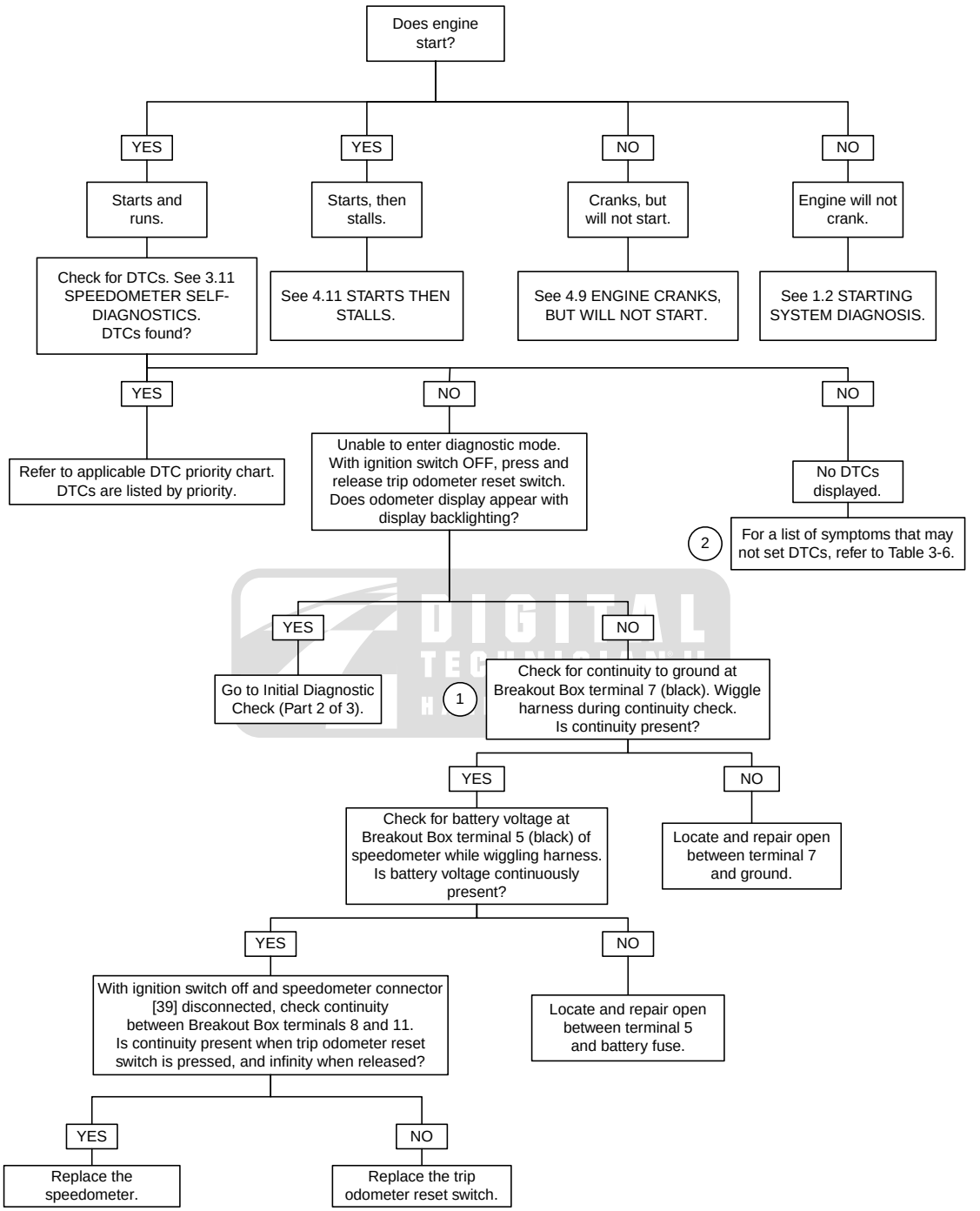
Figure 3-11. Initial Diagnostic Check (FLHR/C)

Table 3-8. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	16-place Molex	Under seat
[30]	TSM/TSSM/HFSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Packard	Back of speedometer (back of console)
[78]	ECM	73-place Packard	Under seat
[91]	DLC	4-place Deutsch	Under left side cover
[166]	ABS module	20-place Molex	Under right side cover

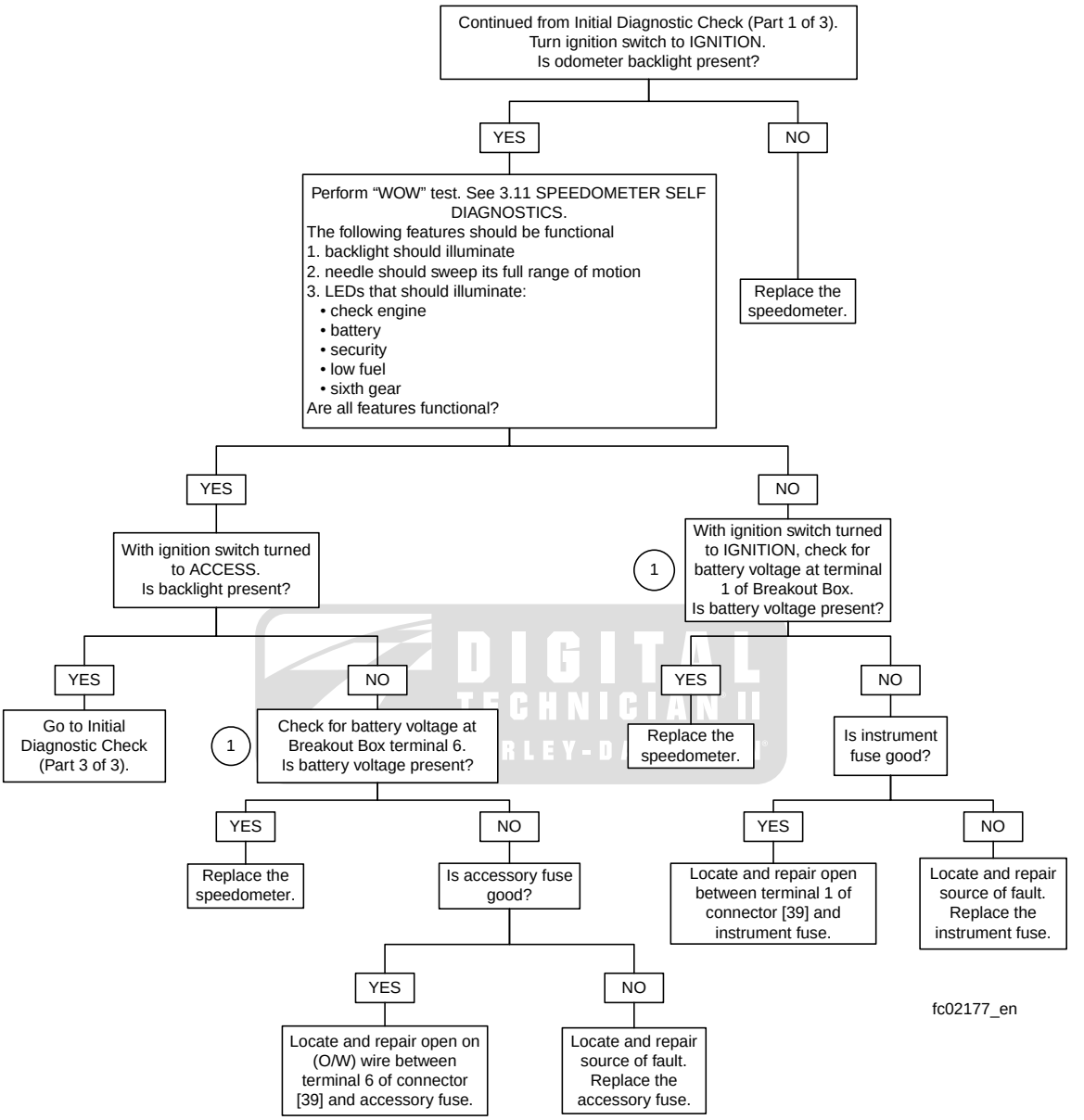
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Initial Diagnostic Check (Part 1 of 3)

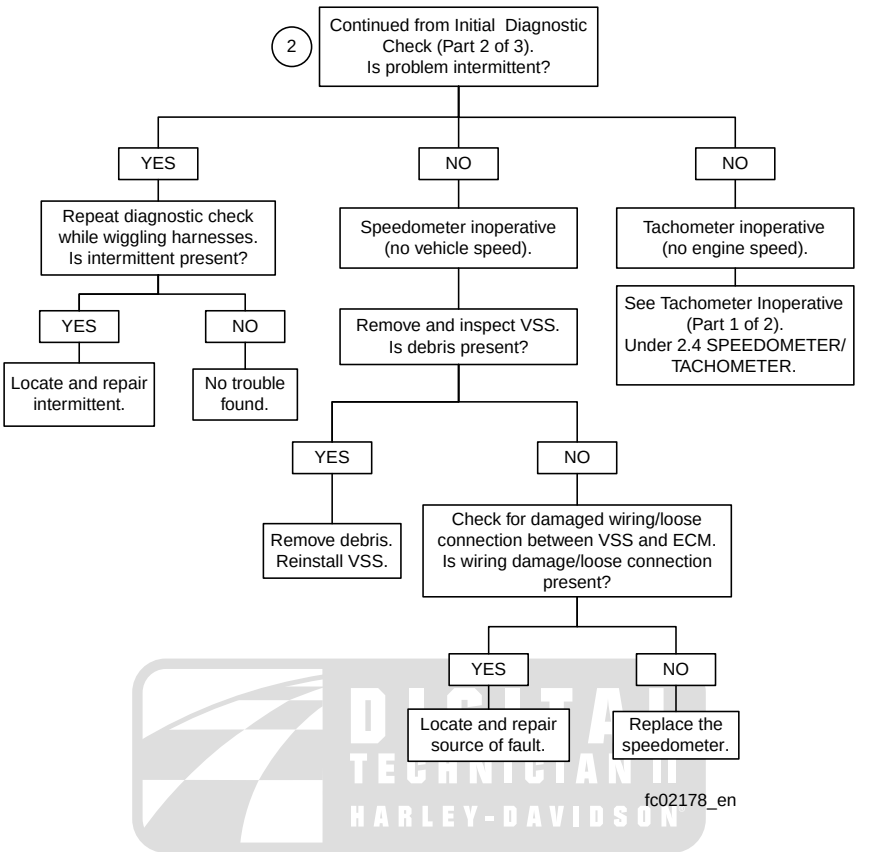


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Initial Diagnostic Check (Part 2 of 3)



Initial Diagnostic Check (Part 3 of 3)



SPEEDOMETER SELF-DIAGNOSTICS 3.11

GENERAL

The speedometer is capable of displaying and clearing speedometer, tachometer, TSM/HFSM, and ECM and ABS DTCs (diagnostic mode).

DIAGNOSTICS

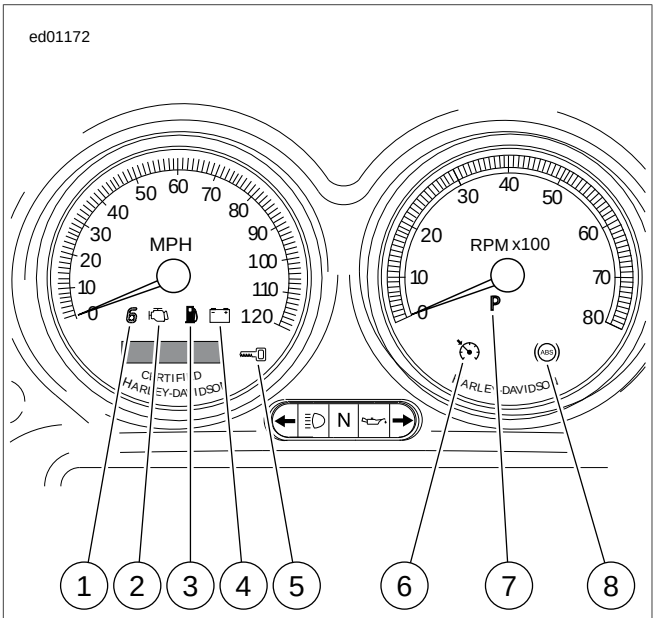
Diagnostic Tips

- For a quick check of speedometer function, a "WOW" test can be performed. Press and hold trip odometer reset switch then turn ignition switch to IGNITION. See Figure 3-13. Release trip odometer reset switch. See Figure 3-12. Background lighting should illuminate, gauge needles should sweep their full range of motion, and indicator lamps (battery, security, low fuel, check engine, ABS, cruise, pursuit, and sixth gear indicator) should illuminate. All lamps should illuminate, even those not used in normal vehicle operation.
- If speedometer fails "WOW" test, check for battery, ground, ignition, trip odometer reset switch, and accessory wiring to speedometer. If any feature in the speedometer is non-functional, see 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.

Diagnostic Notes

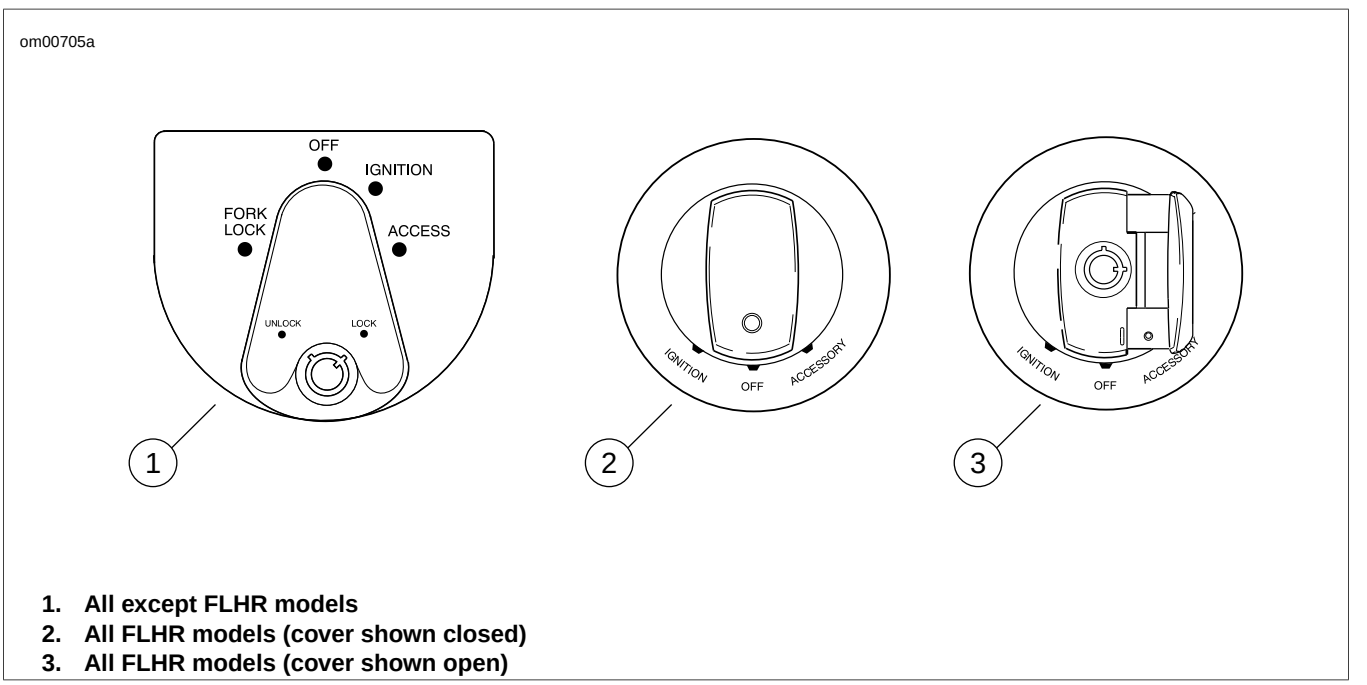
Each reference number below correlates to a circled number on the flowchart(s).

1. To exit diagnostic mode, turn ignition switch OFF.
2. To clear DTCs for the selected module, press the trip odometer reset switch for more than 5 seconds when a DTC is displayed. This procedure clears all DTCs for the selected module.



1. **Sixth gear indicator**
2. **Check engine lamp**
3. **Low fuel lamp**
4. **Battery lamp**
5. **Security lamp (key icon)**
6. **Cruise enabled lamp**
7. **Pursuit lamp**
8. **ABS lamp**

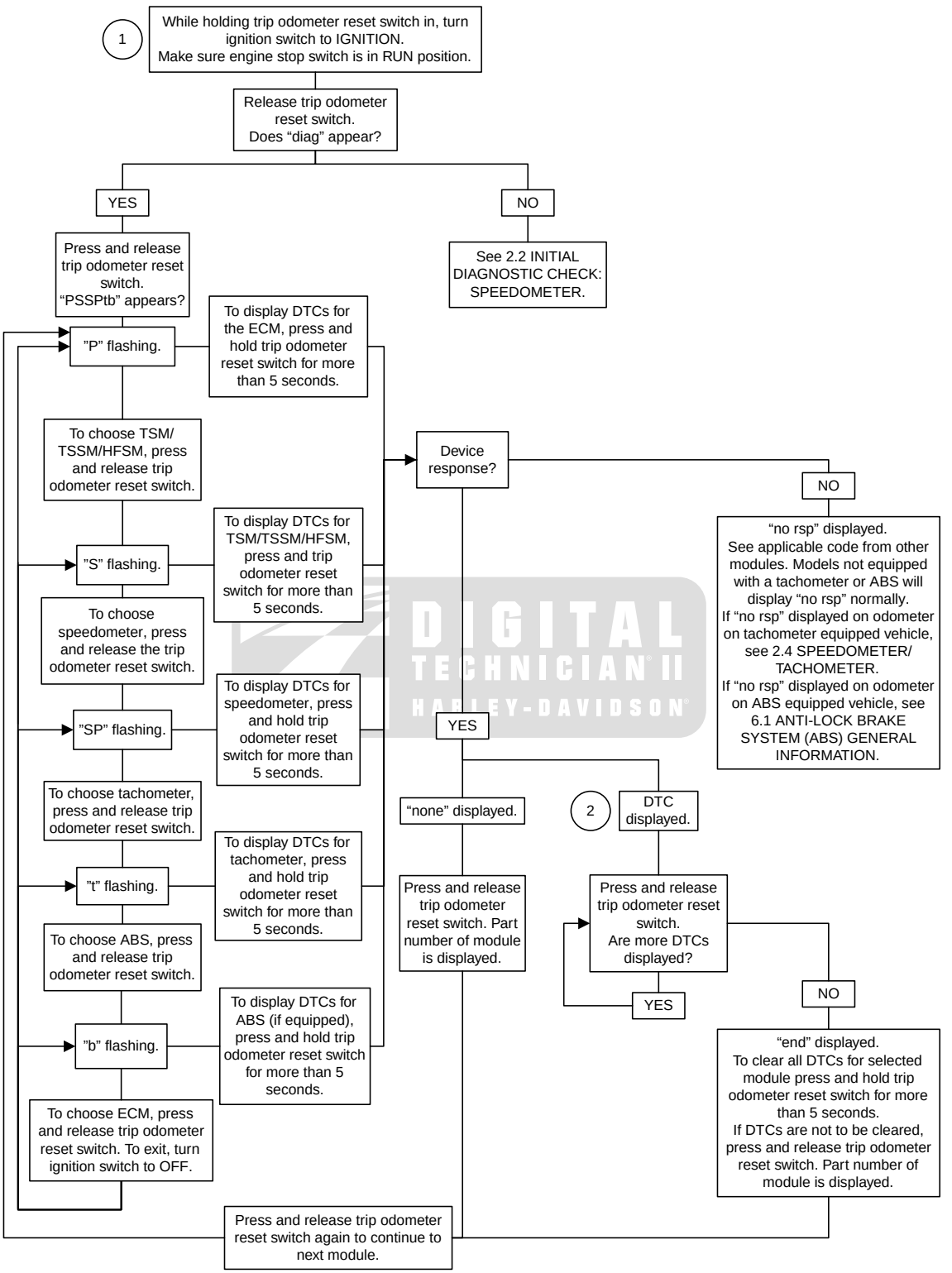
Figure 3-12. Icons (Typical)



1. **All except FLHR models**
2. **All FLHR models (cover shown closed)**
3. **All FLHR models (cover shown open)**

Figure 3-13. Ignition Switch: Touring Models

Speedometer Self-Diagnostics



fc02165_en

BREAKOUT BOX: TSM/HFSM 3.12

GENERAL

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

The BREAKOUT BOX (Part No. HD-42682) splices into the main harness. Used in conjunction with a DVOM, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects.

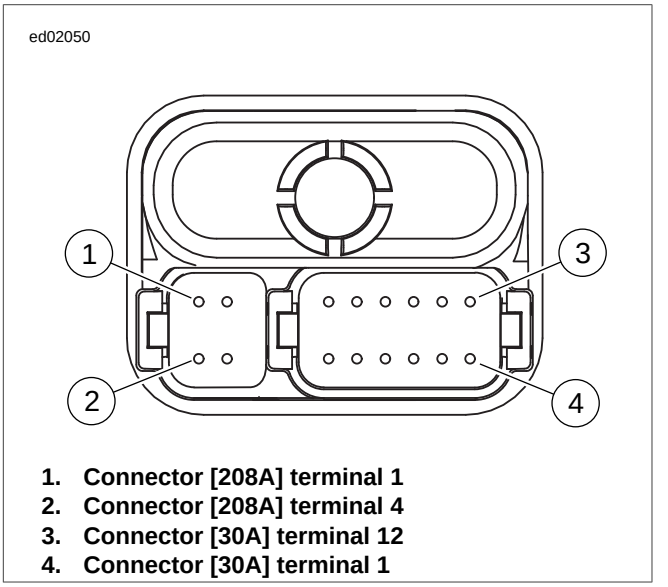
INSTALLATION

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

NOTE

For HFSM, disarm security system, then remove MAXIFUSE while the system remains disarmed.

1. Access TSM/HFSM.
2. See Figure 3-14. Disconnect harness connector(s) from TSM/HFSM:
 a. For HFSM, press latches on antenna connector [208] and remove from antenna connector [208A].
 b. Press latches on main harness connector [30B] and remove from main connector [30A].
3. Attach BREAKOUT BOX (Part No. HD-42682) to connector(s).
 a. Mate gray socket housing on BREAKOUT BOX (Part No. HD-42682) with TSM/HFSM connector [30A].
 b. Mate gray pin housing on BREAKOUT BOX (Part No. HD-42682) with vehicle harness connector [30B].
4. For HFSM, mate antenna connector [208] to HFSM.



1. **Connector [208A] terminal 1**
2. **Connector [208A] terminal 4**
3. **Connector [30A] terminal 12**
4. **Connector [30A] terminal 1**

Figure 3-14. TSM/HFSM Terminal Cavity Numbers

REMOVAL

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

1. See Figure 3-14. For HFSM, press latches on antenna connector [208B] and disconnect from HFSM antenna connector [208A].
2. Disconnect BREAKOUT BOX (Part No. HD-42682) from vehicle:
 a. Press latches and detach gray BREAKOUT BOX (Part No. HD-42682) socket connector from TSM/HFSM main harness connector [30A].
 b. Detach gray BREAKOUT BOX (Part No. HD-42682) connector from TSM/HFSM main harness connector [30B].
3. For HFSM, mate the antenna connector [208B].
4. Mate main harness connector [30B] to TSM/HFSM.
5. Reinstall TSM/HFSM.
6. Install parts removed for access.

NOTE

Vehicle will not start with TSM/HFSM disconnected or incorrectly mounted.

Table 3-9. TSM/HFSM Connector [30B]

TERMINAL	FUNCTION	TERMINAL	FUNCTION
1	Battery 12V	7	Right turn switch input
2	Battery 12V switched	8	Left turn switch input
3	Serial data	9	Start relay ground

Table 3-9. TSM/HFSM Connector [30B]

TERMINAL	FUNCTION	TERMINAL	FUNCTION
4	Neutral switch input	10	Clutch switch input
5	Left turn feed output	11	Alarm signal output
6	Right turn feed output	12	Chassis ground

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FAILS TO DISARM (HFSM ONLY) 3.13

GENERAL

If the HFSM does not consistently respond, or only responds with the fob in a limited range, follow the flowchart.

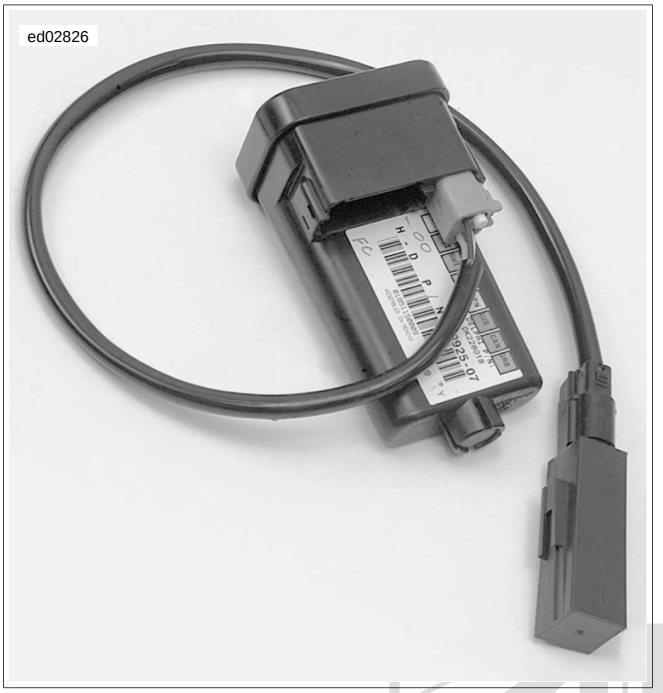


Figure 3-15. HFSM and Antenna

JOB/TIME CODES

Dealership technicians filing warranty claims should use the job/time codes printed in **bold text** underneath the appropriate repair.

DIAGNOSTICS

Diagnostic Tips

- Verify the hands-free antenna or a cell phone is not within 3.0 in. (80 mm) of key fob.
- Interference from physical surroundings may affect RF transmission. Place fob next to motorcycle or move motorcycle to a new location and retest.
- See Figure 3-15. Verify antenna is in OE location and seat has not been replaced with a metal base seat.
- Check for damage to antenna wire.
- See Figure 3-16. Verify fob battery voltage is at least 2.9 Volts. See 3.27 HFSM MAINTENANCE.
- Fob serial number is located inside fob. Open fob by twisting a thin blade in the thumbnail slot between fob halves.



1. **Battery**
2. **Fob serial number**

Figure 3-16. Open Fob: HFSM

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. After a battery disconnect, the HFSM does not enter the configuration mode on the first attempt. All attempts to assign a fob or enter the configuration mode requires at least two attempts.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

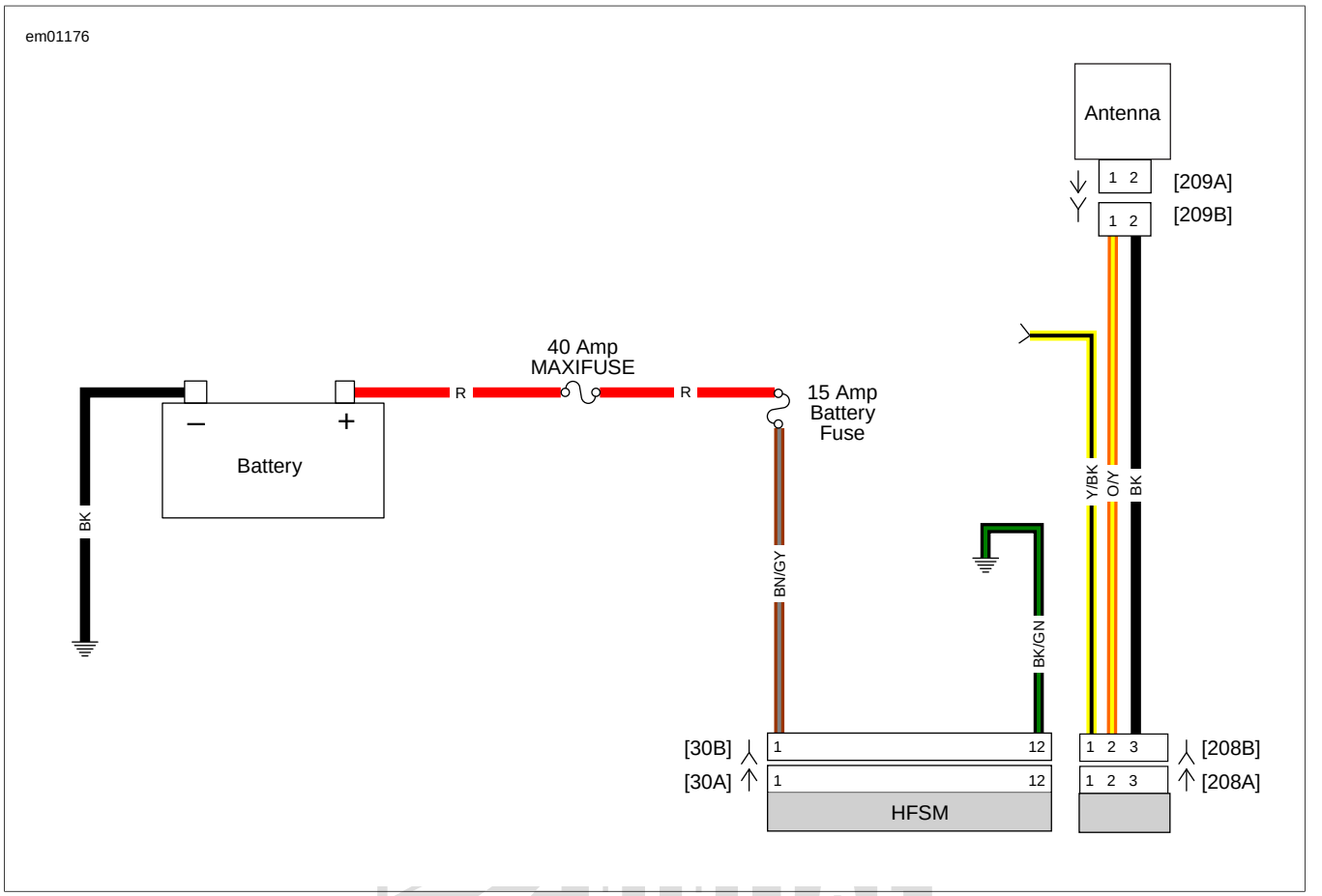


Figure 3-17. Antenna Circuit: HFSM

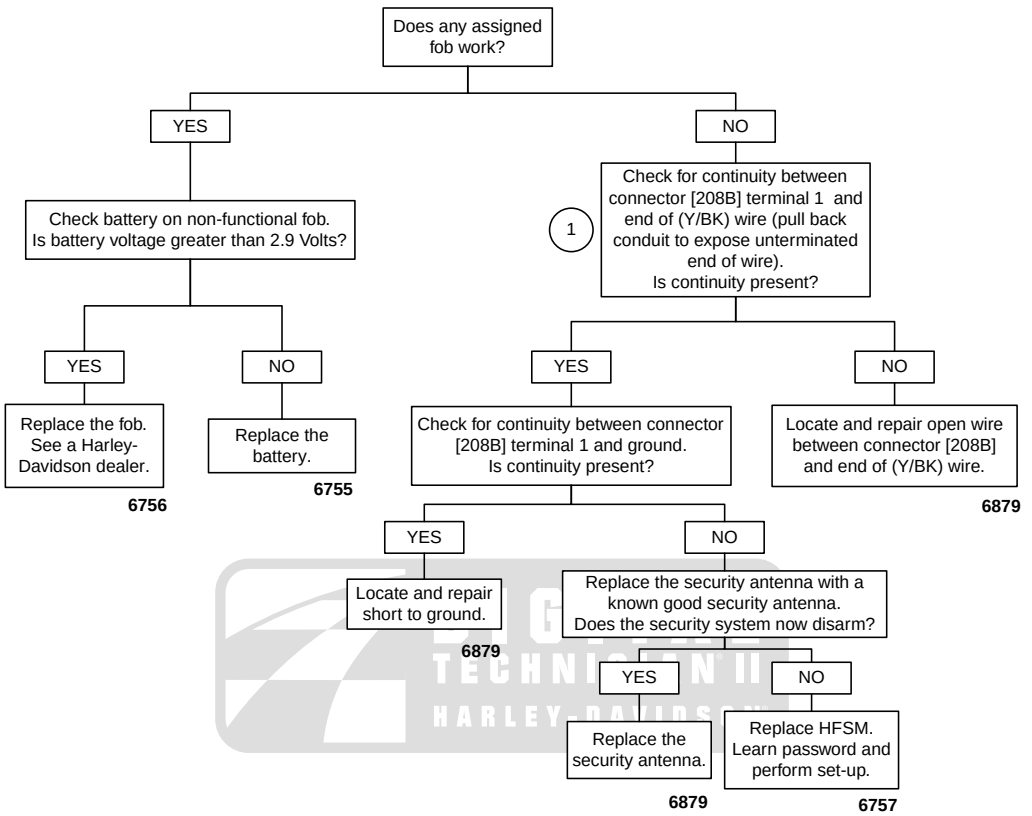
Table 3-10. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[30]	HFSM	12-place Deutsch	Under right side cover
[208]	HFSM antenna jumper harness	4-place Deutsch	Under right side cover
[209]	HFSM antenna	2-place Molex	Under seat

HFSM: Fails to Disarm

NOTE

The fob for the HFSM must be assigned using DIGITAL TECHNICIAN II (Part No. HD-48650). DIGITAL TECHNICIAN II can also validate fob operation when connected to the motorcycle.



fc02180_en

DTC B0563 3.14

GENERAL

The TSM/HFSM continually checks the battery voltage during IGN/OFF and IGN/RUN power modes. If the voltage exceeds 16.0 Volts for more than 5.0 ± 0.5 seconds, the TSM/HFSM sets DTC B0563.

DIAGNOSTICS

Diagnostic Tips

- This DTC may set when the vehicle is placed on a battery charger, on fast charge, for a long period of time.
- The HFSM does not illuminate the security lamp when this DTC is set.

Diagnostic Notes

See 1.7 CHARGING SYSTEM tests to correct. Problem may be faulty voltage regulator.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TSM/HFSM: TURN SIGNAL ERRORS AND DTCS 3.15

GENERAL

The turn signals automatically cancel based on either the speed/acceleration of the vehicle or upon turn completion. See 3.1 TURN SIGNAL OVERVIEW.

TSM/HFSM: For turn signal diagnostics based on symptoms, refer to Table 3-11.

TSM DTCs Only: Refer to Table 3-12.

HFSM DTCs Only: Refer to Table 3-13.

Table 3-11. Turn Signal Symptoms: TSM/HFSM

DTC	SYMPTOM	START WITH FLOWCHART
N/A	Turn signal will not cancel on turn completion	Will Not Cancel on Turn Completion
N/A	Turn signal cancels erratically	Cancels Erratically
N/A	Turn signals flash at double normal rate, all bulbs work	Flash at Double Normal Rate, All Bulbs Work

Table 3-12. Turn Signal DTCs: TSM Only

DTC	SYMPTOM	START WITH FLOWCHART
B1121	Turn signals will not flash, 4-way flashers inoperable	DTCs B1121, B1122, and B1141, Will Not Flash, 4-Way Flashers Inoperable (Part 1 of 4)
B1122		
B1141		

DIGITAL

Table 3-13. Turn Signal DTCs: HFSM Only

DTC	SYMPTOM	START WITH FLOWCHART
B1121	Left turn signal inoperable	DTCs B1121 and B1122, Turn Signal Lamp Open Circuit
B1122	Right turn signal inoperable	DTCs B1121 and B1122, Turn Signal Lamp Open Circuit
B1123	Left turn signal inoperable	DTCs B1123, B1124, B1125, and B1126
B1124	Right turn signal inoperable	DTCs B1123, B1124, B1125, and B1126
B1125	Left turn signal inoperable	DTCs B1123, B1124, B1125, and B1126
B1126	Right turn signal inoperable	DTCs B1123, B1124, B1125, and B1126

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX

Job/Time Codes

Dealership technicians filing warranty claims should use the job/time code printed in **bold text** underneath the appropriate repair in the following diagnostic flowcharts.

Diagnostic Tips

- **TSM Only:** DTCs B1121 and B1122 illuminate the security lamp. DTC B1141 will **not** illuminate the security lamp.
- **HFSM Only:** DTCs B1121, B1122, B1123, B1124, B1125, and B1126 illuminate the security lamp.
- **TSM/HFSM:** When an over current or short-to-ground condition is detected, it turns off the turn lamp outputs.

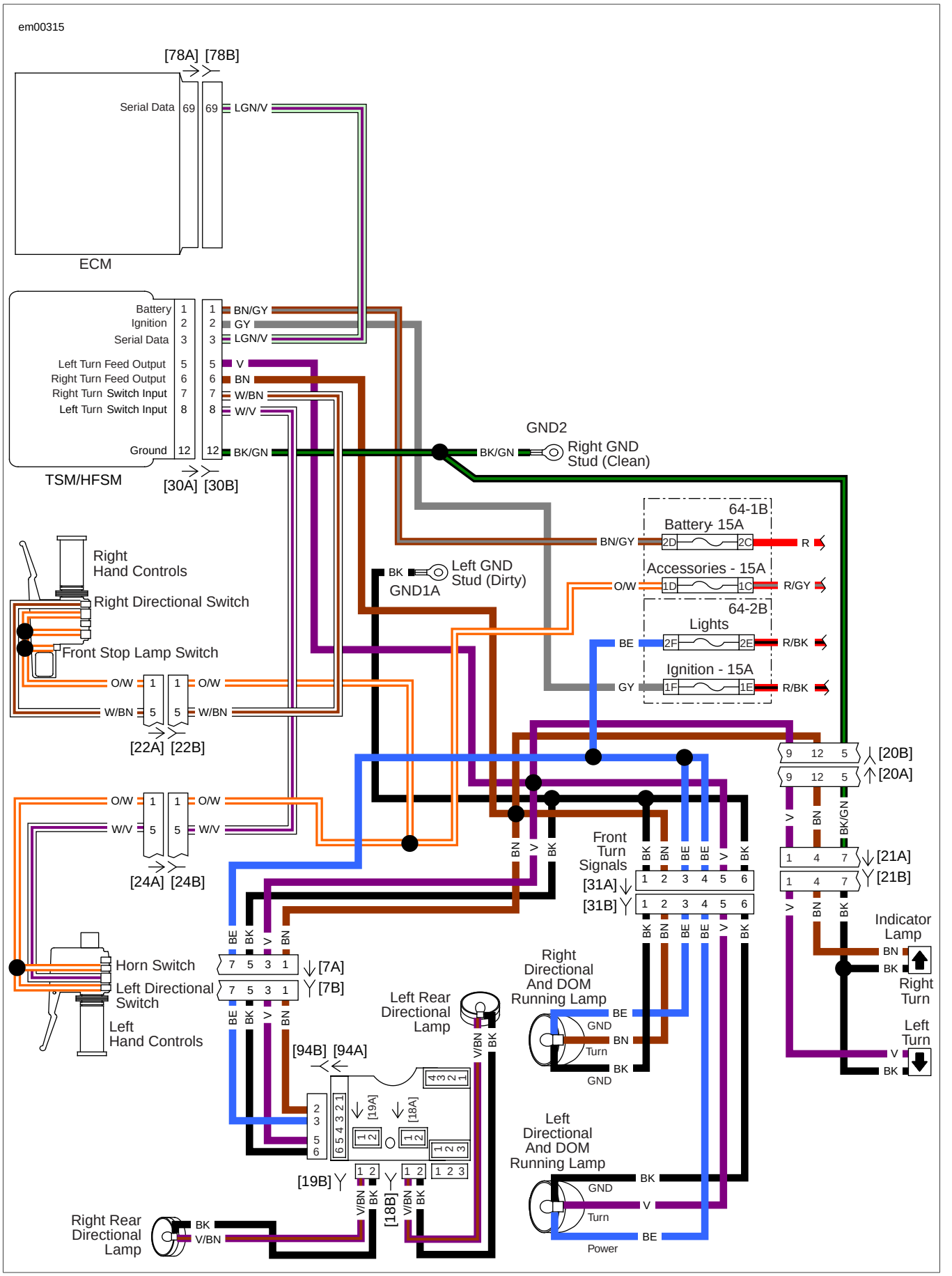


Figure 3-18. Turn Signal Circuit (FLHR/C)

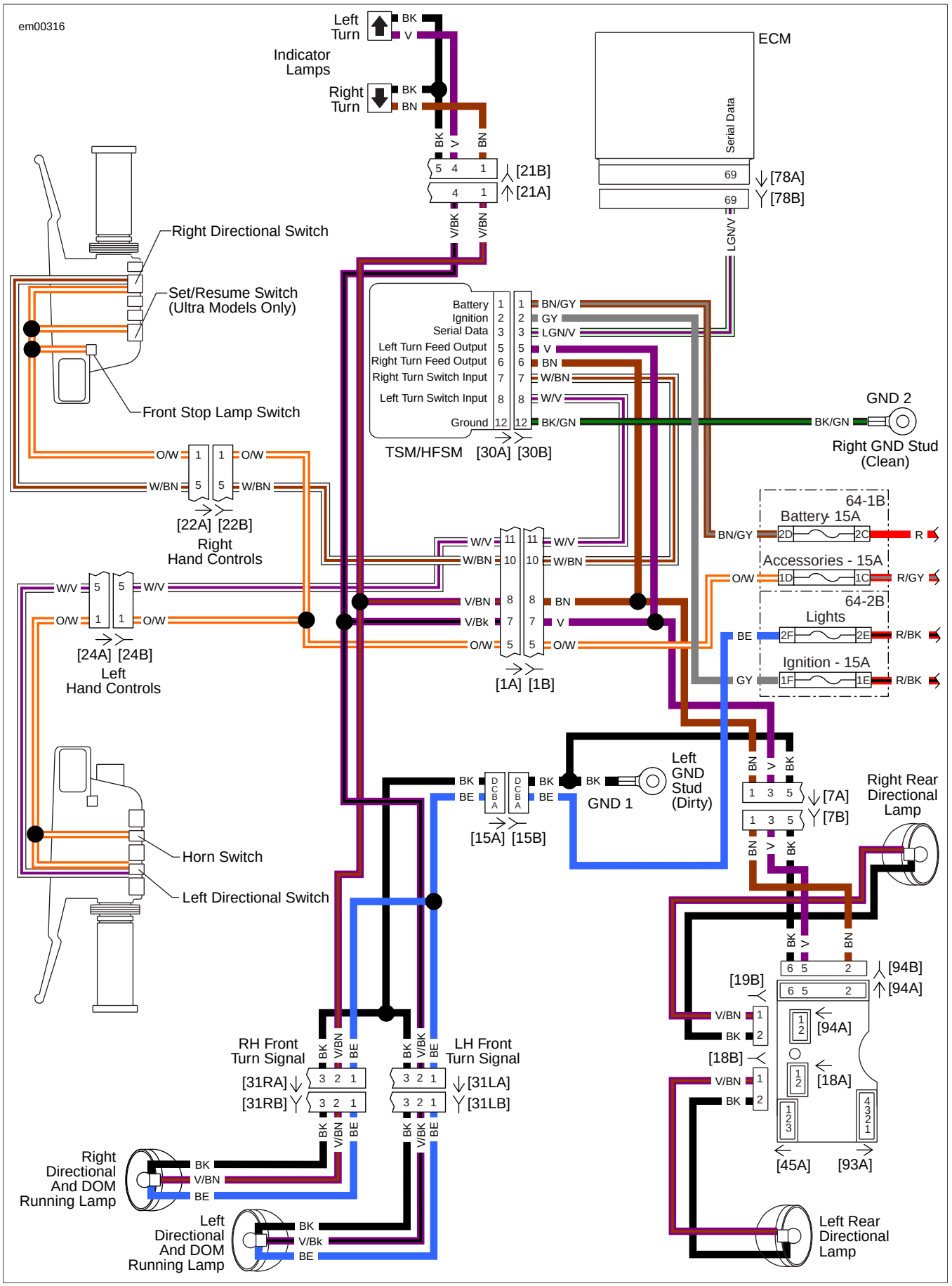


Figure 3-19. Turn Signal Circuit (FLHX, FLHT/C/U, FLTR)

Table 3-14. Wire Harness Connectors

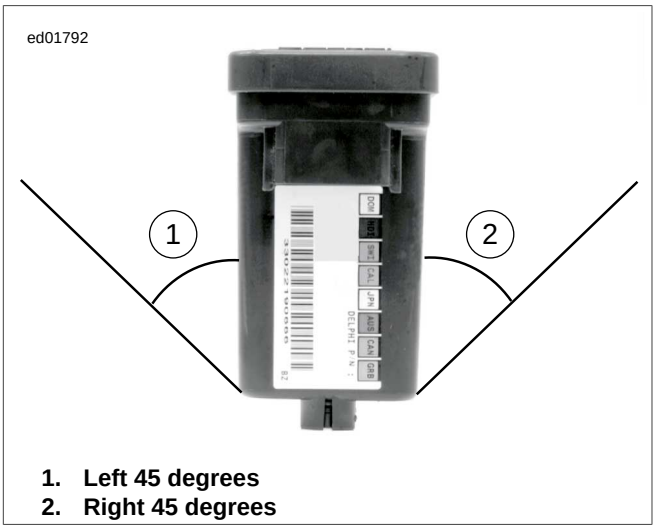
NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHX, FLHT/C/U	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side below radio
[7]	Rear fender lights harness	All	8-place Multilock	Top of rear fender (under seat)
[15]	Main to interconnect harness	FLHX, FLHT/C/U	4-place Packard	Inner fairing - right fairing bracket
		FLTR	4-place Packard	Inner fairing - below radio (right side)
[18]	Left rear turn signal	All	2-place Multilock	Circuit board under tail lamp assembly
[19]	Right rear turn signal	All	2-place Multilock	Circuit board under tail lamp assembly
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[21]	Indicator lamps	FLHR/C	8-place Deutsch	Under console
		FLHX, FLHT/C/U	10-place Multilock	Inner fairing (above radio)
		FLTR	10-place Multilock	Inside instrument Nacelle
[22]	Right handlebar switches	FLHR/C	6-place Molex (Black)	Inside headlamp nacelle - fork stem nut lock plate (right side)
		FLHX, FLHT/C/U	12-place Molex (Black)	Inner fairing - right fairing support bracket
		FLTR	12-place Molex (Black)	Left side radio bracket
[24]	Left handlebar switches	FLHR/C	8-place Molex (Gray)	Inside headlamp nacelle - fork stem nut lock plate (left side)
		FLHX, FLHT/C/U	16-place Molex (Gray)	Inner fairing - left fairing support brace
		FLTR	16-place Molex (Gray)	Left side radio bracket
[30]	TSM/HFSM	All	12-place Deutsch	Under right side cover
[31]	Left/right front turn signal/auxiliary lamp	FLHR/C	6-place Multilock	Inside headlamp nacelle - fork stem nut lock plate (left side)
		FLHX, FLHT/C/U/FLTR	4-place Multilock	Inner fairing - left/right fairing support bracket
[33]	Ignition switch	FLHR/C	3-place Packard	Under console
		FLHX, FLHT/C/U/FLTR	3-place Packard	Bottom of ignition switch
[78]	ECM	All	73-place Packard	Under seat
[94]	Rear fender lights harness in circuit board	All	6-place Multilock	Circuit board under tail lamp assembly
[222]	Main to ignition harness	FLHR/C	4-place Packard	Under seat
[GND1] [GND1A] [GND2]	Harness grounds	All	Ring terminals	Under seat

Diagnostic Notes: All Turn Signal Flowcharts

Each reference number below correlates to a circled number on the flowchart(s).

1. Gain access to motorcycle's TSM/HFSM.

2. Perform the following procedure:
 a. See Figure 3-20. Position TSM/HFSM in same orientation it is mounted on vehicle. Turn ignition switch on. Turn 4-way flashers on by pressing both left and right turn signal switches simultaneously. Turn ignition switch off; 4-way flashers should continue to flash.
 b. Tilt TSM/HFSM greater than 45 degrees to the left.
 c. Repeat step a.
 d. Tilt TSM/HFSM greater than 45 degrees to the right.
3. To enable diagnostic mode, see 3.9 CHECKING FOR DIAGNOSTIC TROUBLE CODES.
4. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/HFSM connector [30A] and wiring harness connector [30B]. See 3.12 BREAKOUT BOX: TSM/HFSM.
5. Closely inspect handlebar controls for pinched wiring.
6. Connect purple HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) adapters and patch cords to connector [22] (right) or connector [24] (left).
7. Replace HFSM if DTC is current (lamp on continuously, cleared codes return during operation). If DTC is historic, check for intermittents.

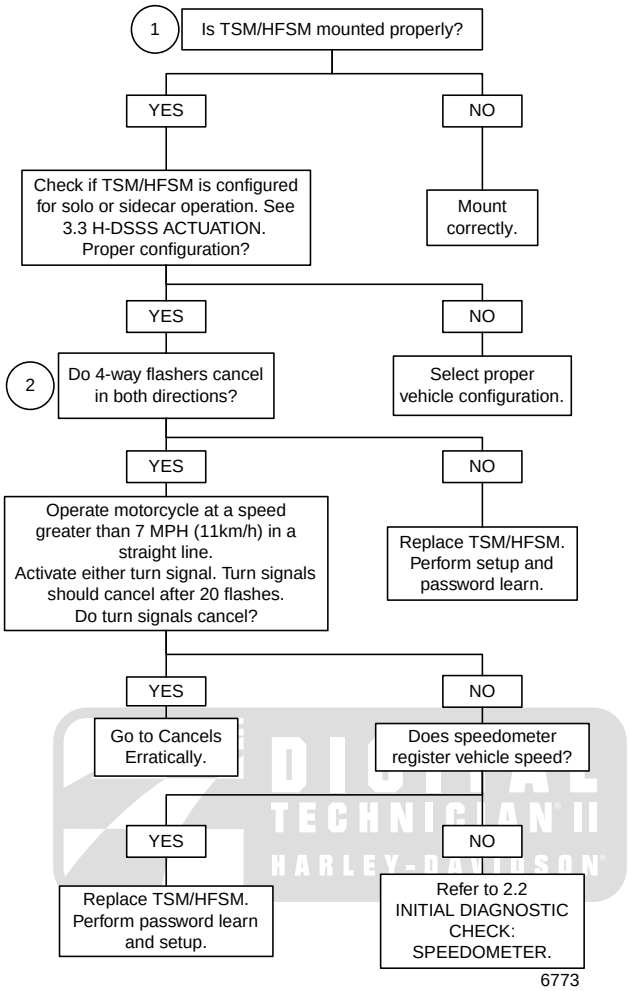


1. Left 45 degrees
2. Right 45 degrees

Figure 3-20. Tilting TSM/HFSM

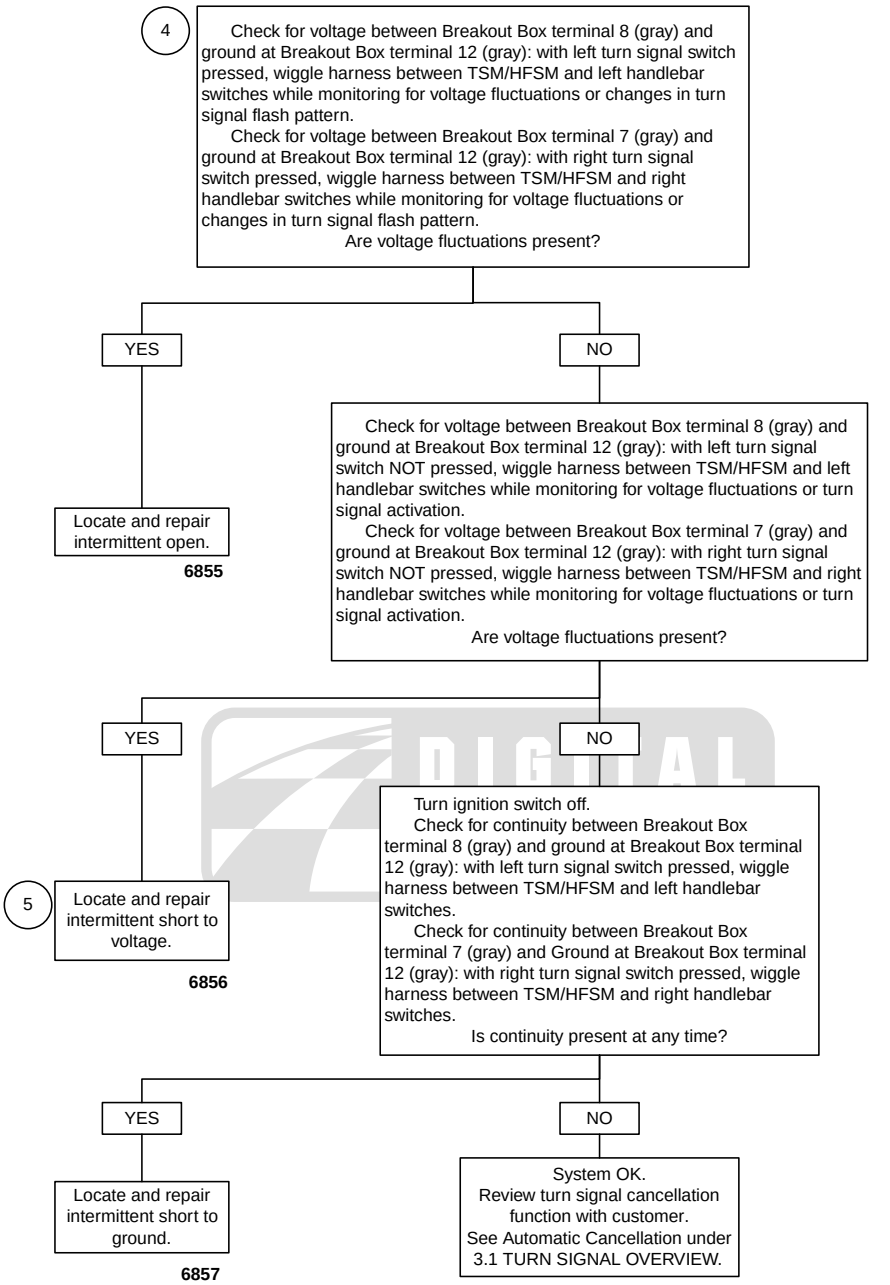
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Will Not Cancel on Turn Completion



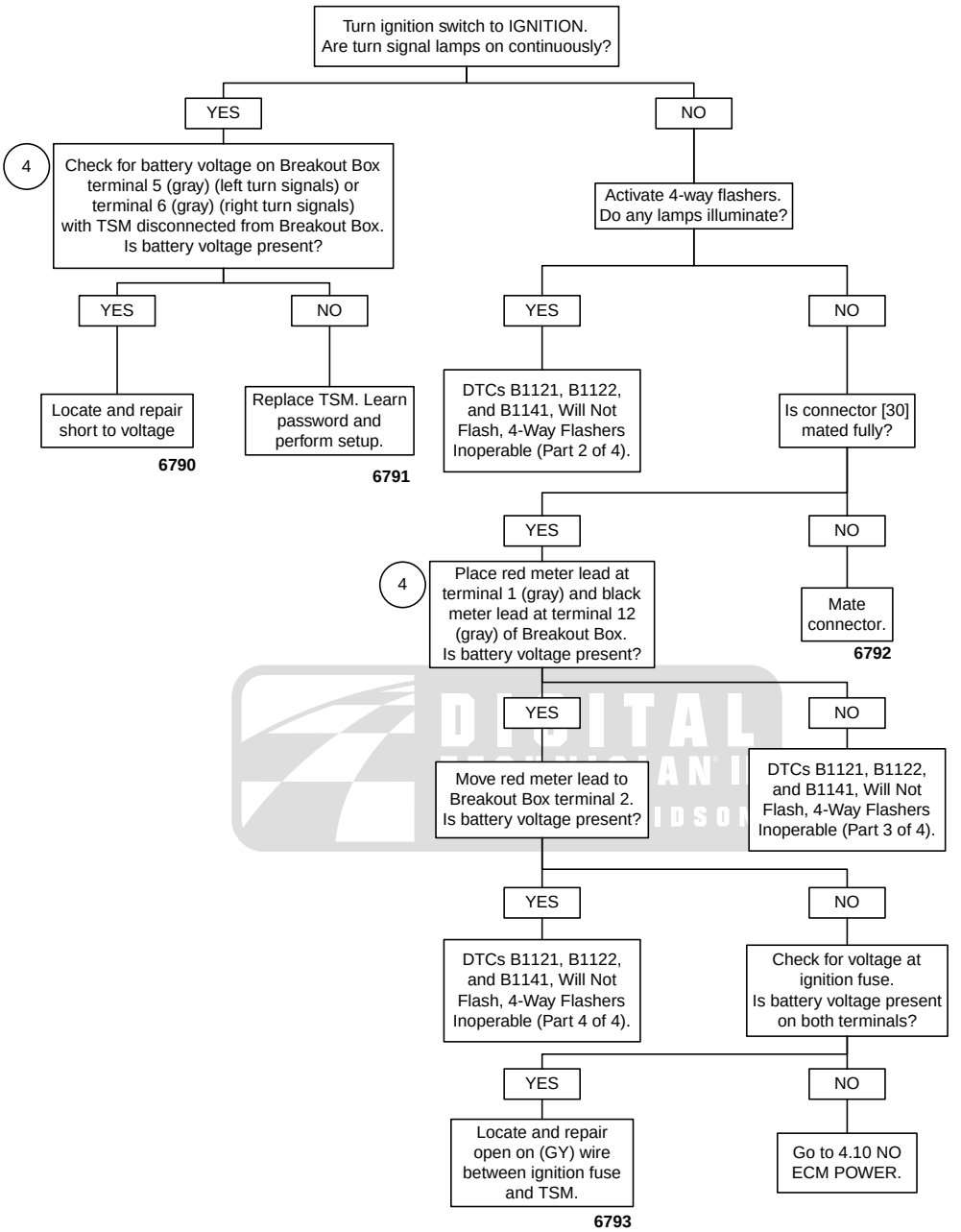
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Cancels Erratically



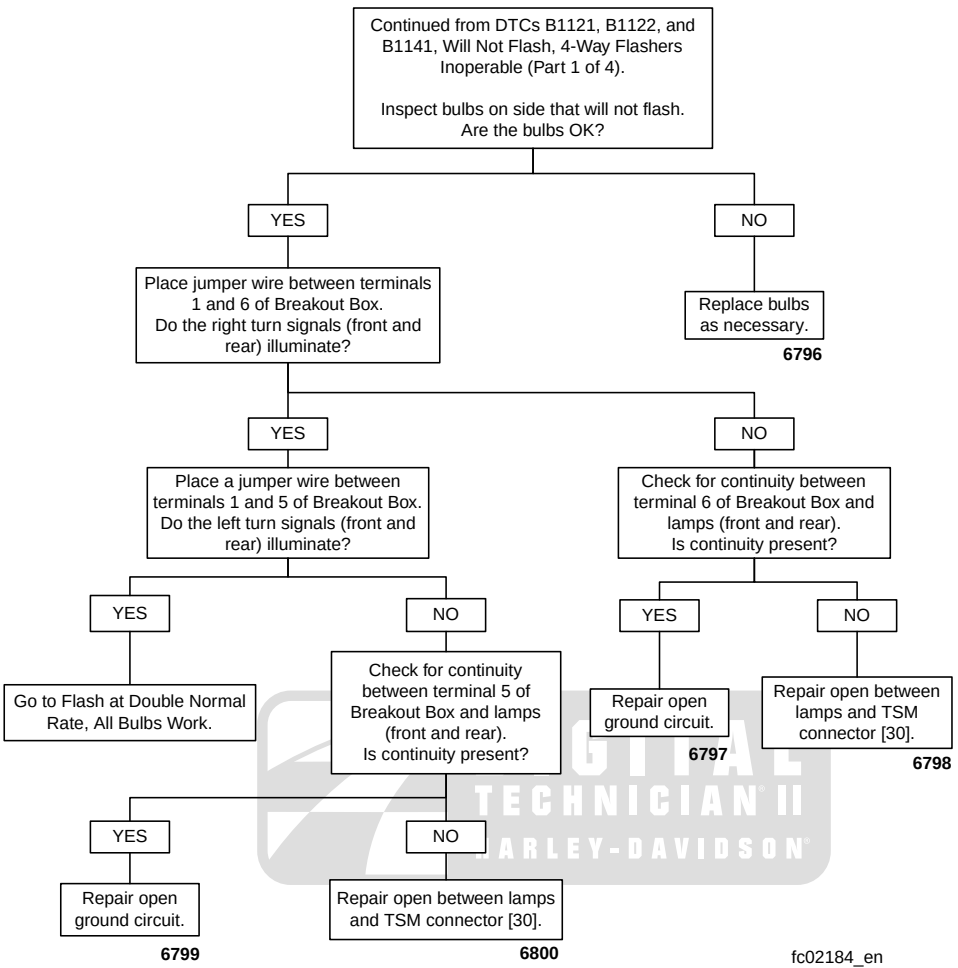
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DTCs B1121, B1122, and B1141, Will Not Flash, 4-Way Flashers Inoperable (Part 1 of 4)

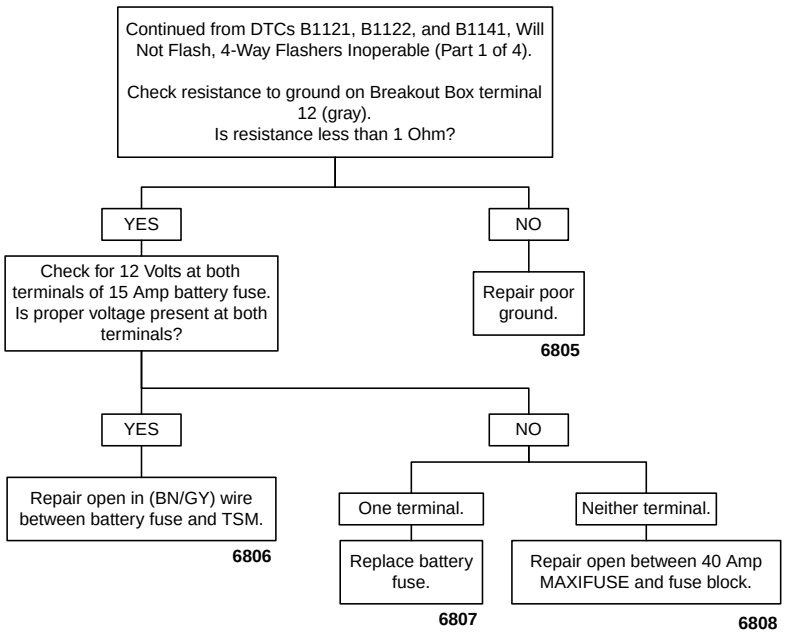


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DTCs B1121, B1122, and B1141, Will Not Flash, 4-Way Flashers Inoperable (Part 2 of 4)



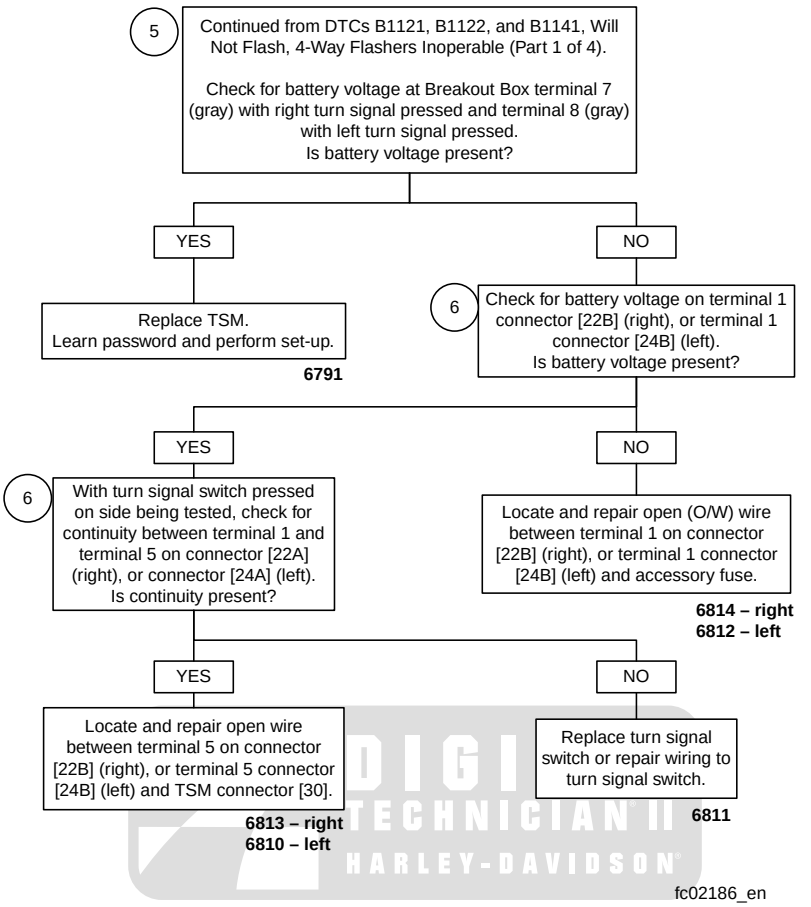
DTCs B1121, B1122, and B1141, Will Not Flash, 4-Way Flashers Inoperable (Part 3 of 4)



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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

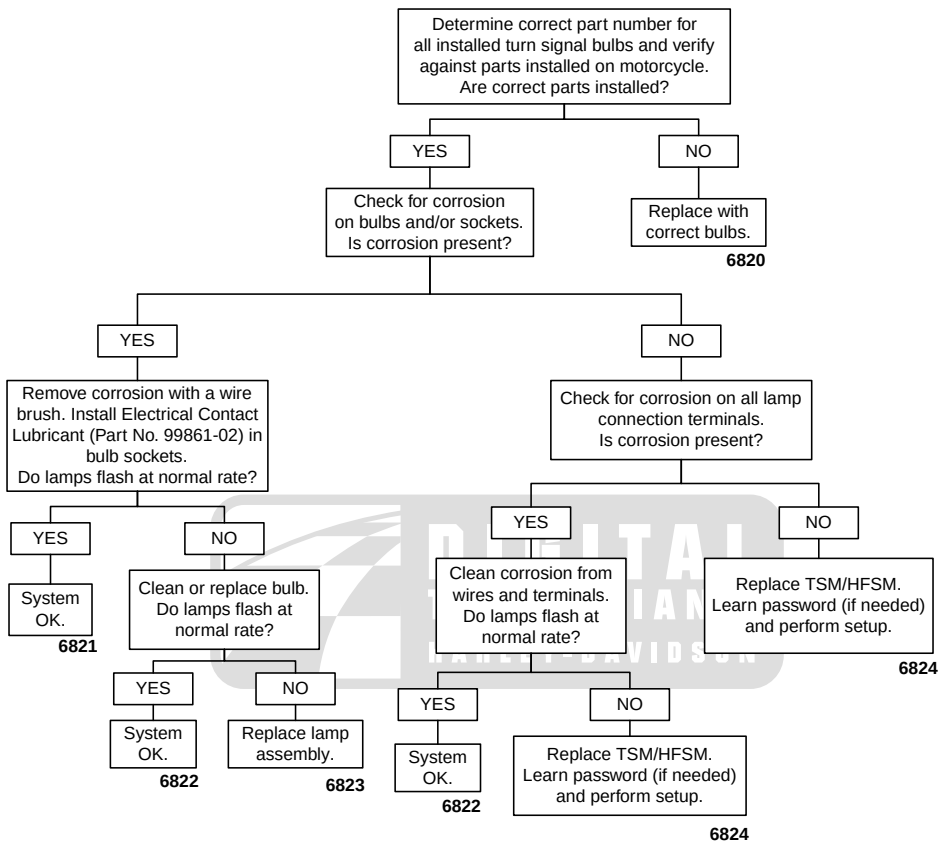
DTCs B1121, B1122, and B1141, Will Not Flash, 4-Way Flashers Inoperable (Part 4 of 4)



Flash at Double Normal Rate, All Bulbs Work

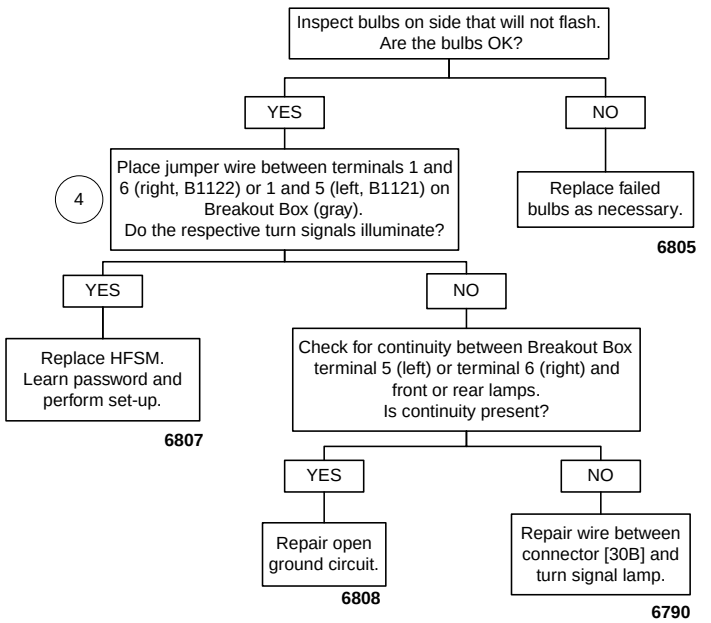
NOTE
Before troubleshooting this issue you should verify the lamp loads have been learned by:

1. Turn ignition switch OFF-IGNITION.
2. Activate left turn lamps for four or more flashes.
3. Activate right turn lamps for four or more flashes.



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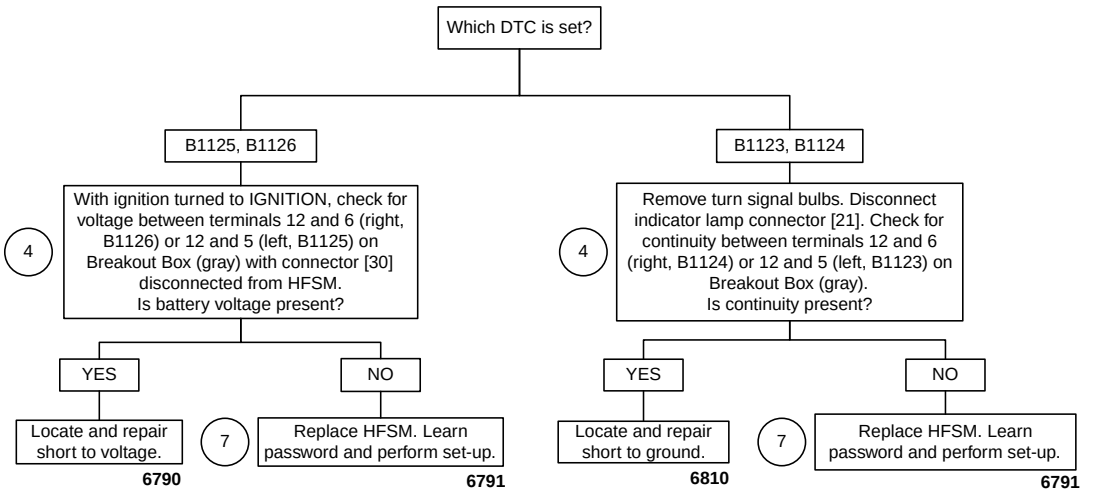
DTCs B1121, B1122, Turn Signal Lamp Open Circuit



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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTCs B1123, B1124, B1125, and B1126



fc02188_en

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1131, B1132 (HFSM ONLY) 3.16

GENERAL

NOTE

This section applies only to those vehicles equipped with the optional security system.

See Figure 3-21. An alarm cycle is activated when the HFSM is connected, the siren has been armed by the HFSM and a security event occurs. See 3.6 WARNINGS AND ALARMS. Under normal armed operation, the siren input (terminal B) is driven low by the HFSM to trigger the audible alarm. When the siren input is driven high by the HFSM the audible alarm stops.

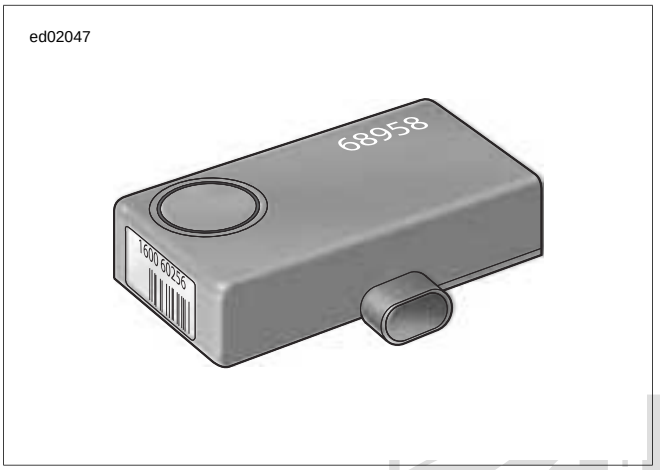


Figure 3-21. Security Siren

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX

Diagnostic Tips

- If the siren is armed and the internal siren battery is dead, shorted, disconnected, or has been charging for a period longer than 24 hours, the siren responds with three chirps on arming instead of two.
- The internal siren battery may not charge if the vehicle's battery is less than 12.5 Volts.
- If the siren does not chirp two or three times on a valid arming command from the HFSM, the chirp function has been disabled, the siren is either not connected, not working, or the siren wiring was opened or shorted while the siren was disarmed.
- If the siren enters the self-driven mode where it is powered from the siren internal nine-volt battery, the turn-signal lamps will not alternately flash. If the HFSM activates the siren, the turn-signal lamps flash. If the siren has been armed and a security event occurs, and the siren is in self-driven mode, the siren alarms for 20-30 seconds and then turn off for 5-10 seconds. This alarm cycle is repeated ten times if the siren is in the self-driven mode.
- If the siren does not stop alarming after it has been armed, then either the HFSM output or siren input may be shorted to ground, or the siren vehicle battery connection is open or shorted to ground, or the siren vehicle ground connection is open, or a security event has occurred. See 3.6 WARNINGS AND ALARMS for a description of alarm functions.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Use BREAKOUT BOX (Part No. HD-42682) and HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord. See 3.12 BREAKOUT BOX: TSM/HFSM.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray socket probe and patch cord.
3. Having the correct multimeter Ohm scale is important for this test. Some meters may read infinity for high Ohm values. If this is the case, check your Ohm scale and retest.

Table 3-15. Siren Alarm Output DTCs

DTC	SYMPTOM	START WITH FLOWCHART
B1131	Alarm output low	DTCs B1131 and B1132
B1132	Alarm output high	

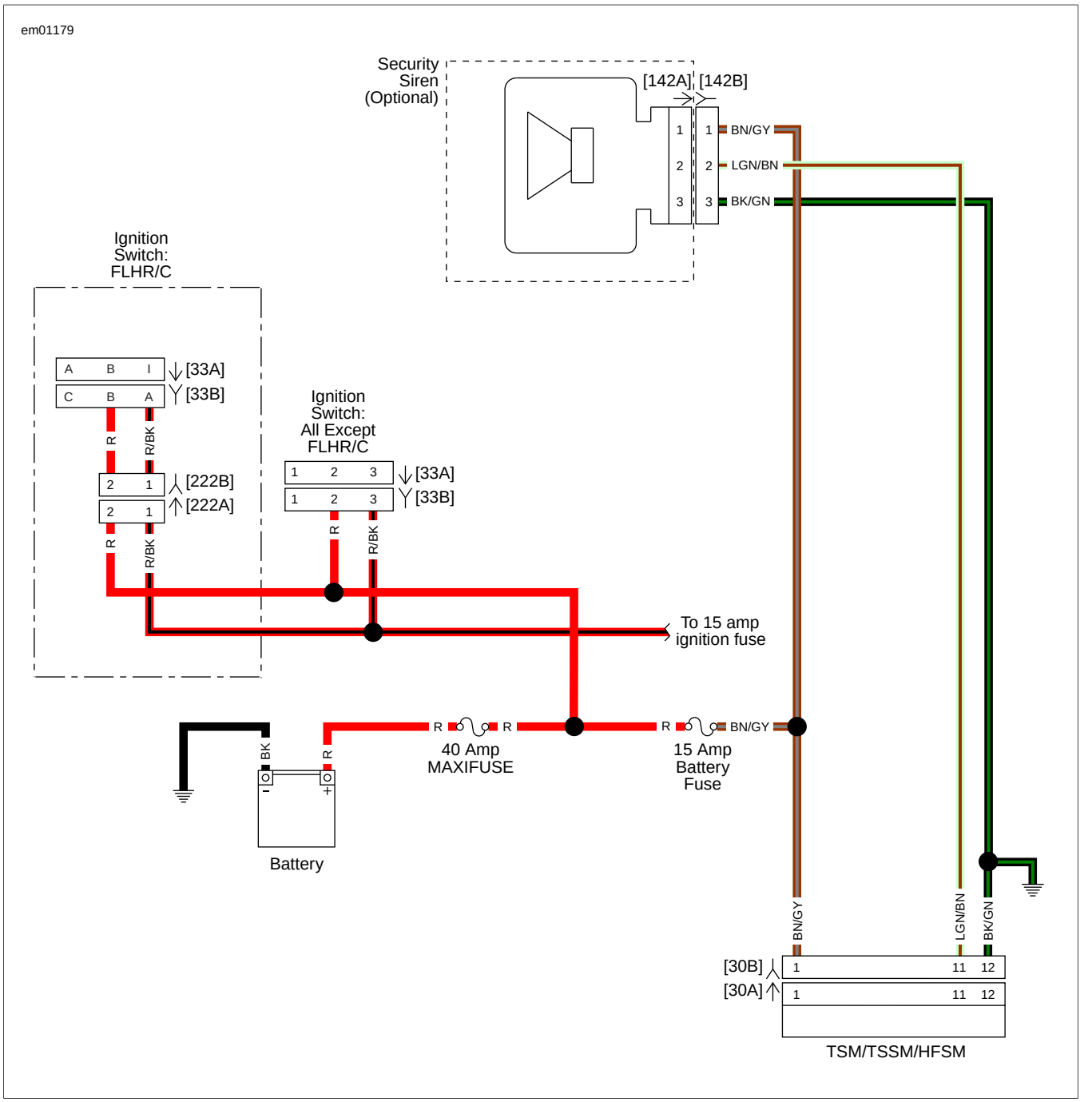
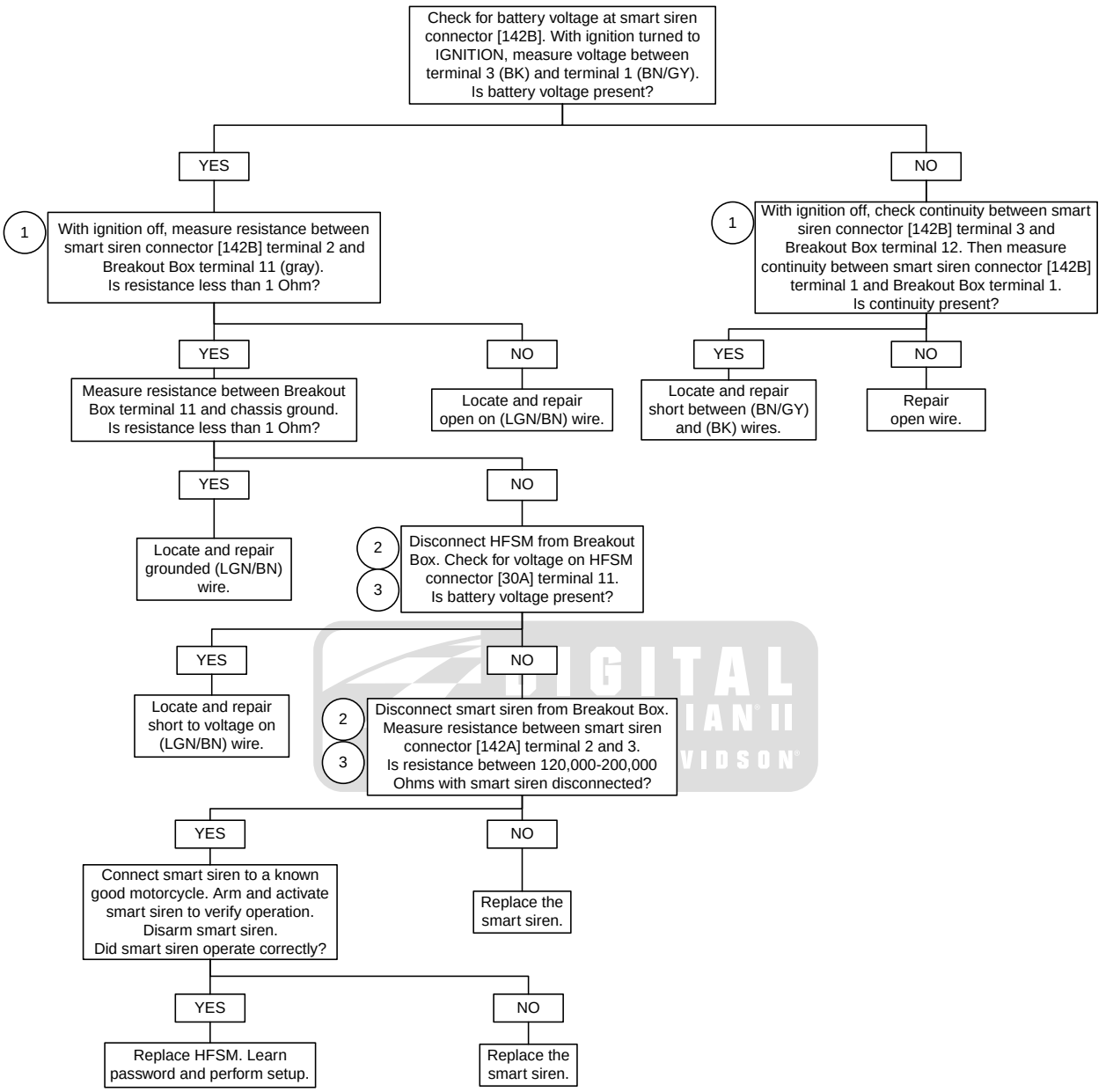


Figure 3-22. Smart Siren Circuit

Table 3-16. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[30]	HFSM	12-place Deutsch	Under right side cover
[33]	Ignition switch	3-place Packard	Bottom of ignition switch, FLHR/C under console
[142]	Security siren	3-place Packard	Under left side cover
[222] (FLHR models only)	Main to ignition harness	4-place Packard	Under seat

DTCs B1131 and B1132



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DTC B1134 3.17

GENERAL

DTC B1134 Starter Output High

With the HFSM (if equipped) disarmed, the ignition switch set to IGNITION, the transmission in neutral or the clutch pulled in, and the engine stop switch set to RUN, the start relay is grounded. Battery voltage is applied to the start relay and coil which are grounded through the TSM/HFSM.

DTC B1134 sets when that ground is not established through the TSM/HFSM. Refer to flowchart.

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) to wire harness connector [30] leaving TSM/HFSM disconnected. See 3.12 BREAKOUT BOX: TSM/HFSM.

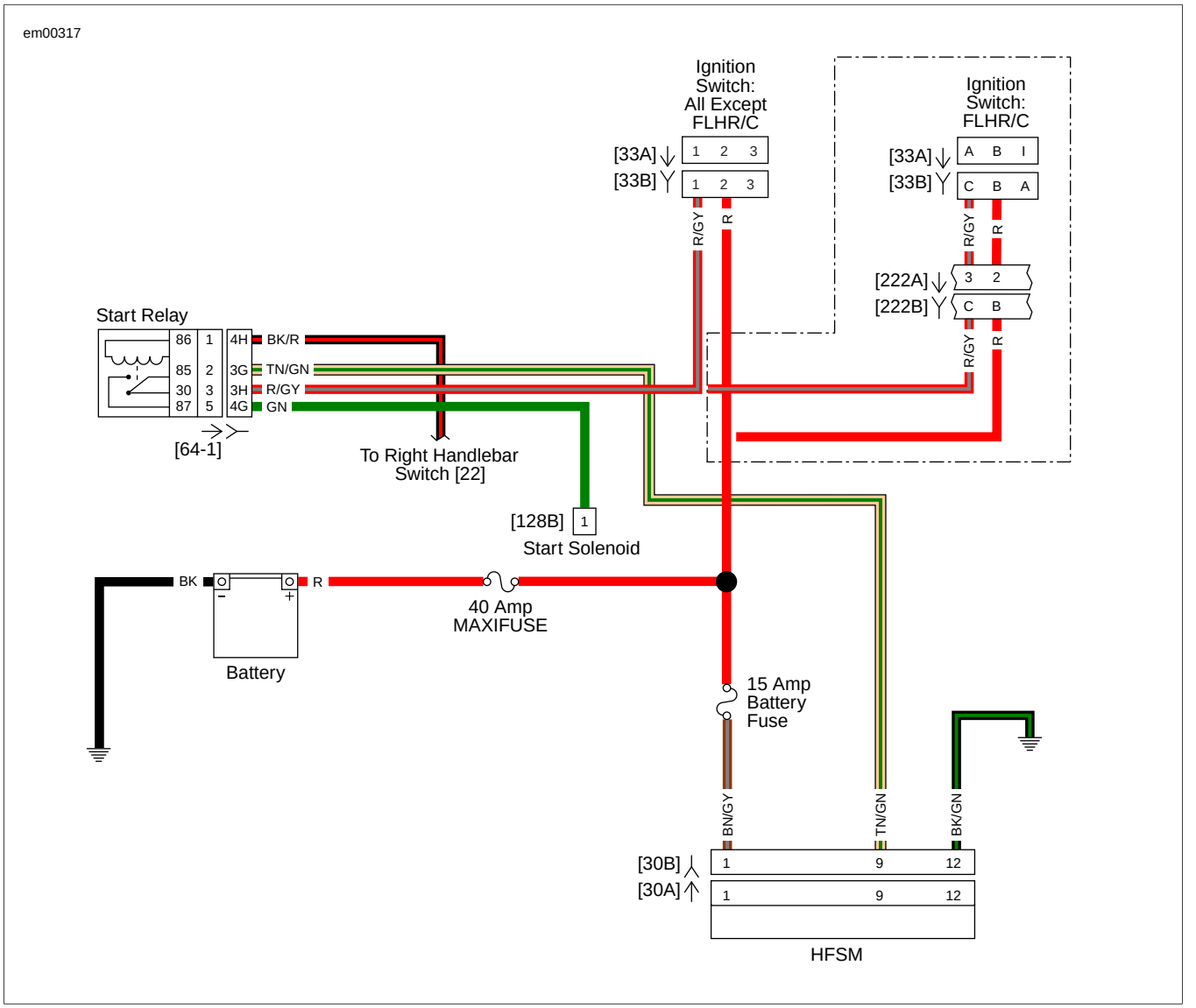


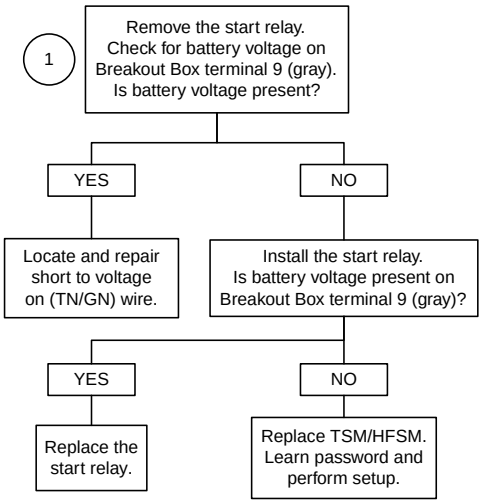
Figure 3-23. Starter/HFSM Circuit

Table 3-17. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[22]	Interconnect to right handlebar switches	FLHX, FLHT/C/U/FLTR	12-place Molex (Black)	Inner fairing - right fairing support bracket
	Right handlebar switches	FLHR/C	6-place Molex (black)	Inside headlamp nacelle - fork stem nut lock plate (right)
[30]	TSSM/HFSM	All	12-place Deutsch	Under right side cover
[33]	Ignition switch	FLHX, FLHT/C/U/FLTR	3-place CompX	Bottom of ignition switch
		FLHR/C	3-place Packard	Under console
[62]	Start relay	All	Fuse Block	Fuse block (under left side cover)
[128]	Starter solenoid	All	Spade terminals	Top of starter
[222]	Main to ignition switch	FLHR/C	4-place Packard	Under seat

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1134



Clear DTCs using speedometer self-diagnostics. See 3.11 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1135 3.18

DIAGNOSTICS

DTC B1135 Accelerometer Fault

DTC B1135 indicates a failure which requires replacement of the TSM/HFSM.

NOTE

When DTC B1135 is set, the tip-over engine shutdown, HFSM tamper alarm and bank angle sensors are disabled. The security lamp also illuminates when this code is set.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1136, B1142 (HFSM ONLY) 3.19

DTC B1136 ACCELEROMETER TIP-OVER SELF-TEST FAULT AND DTC B1142 INTERNAL FAULT

DTCs B1136 and B1142 indicate a failure which requires replacement of the HFSM.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1141 (HFSM ONLY) 3.20

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX

DTC B1141 Ignition Switch Open/Low

DTC B1141 or a symptom of Will Not Flash can be diagnosed using the flowcharts.

Diagnostic Notes

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/HFSM connector [30A] and wiring harness connector [30B]. See 3.12 BREAKOUT BOX: TSM/HFSM.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple terminal probe and patch cord.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

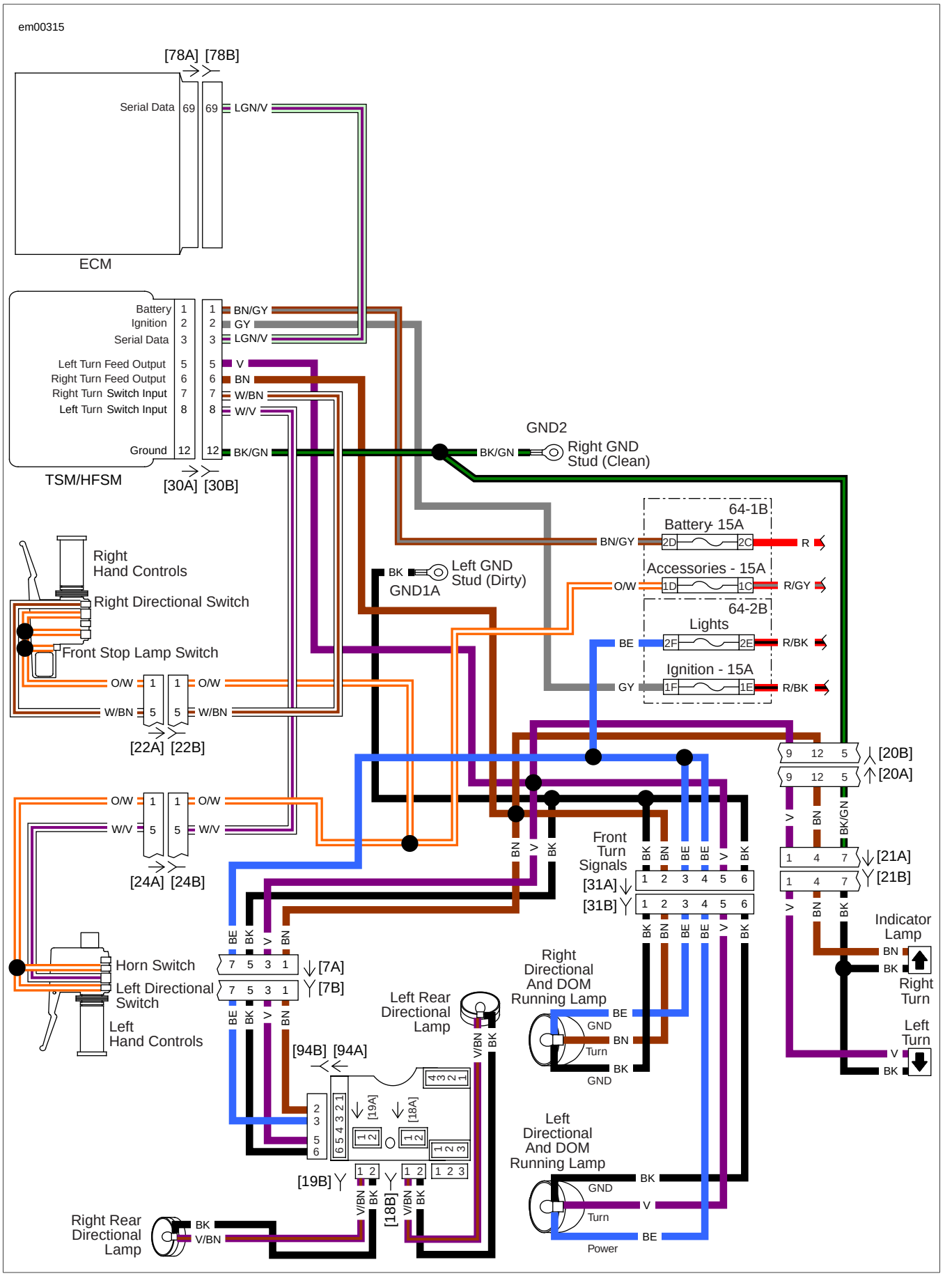


Figure 3-24. Turn Signal Circuit (FLHR/C)

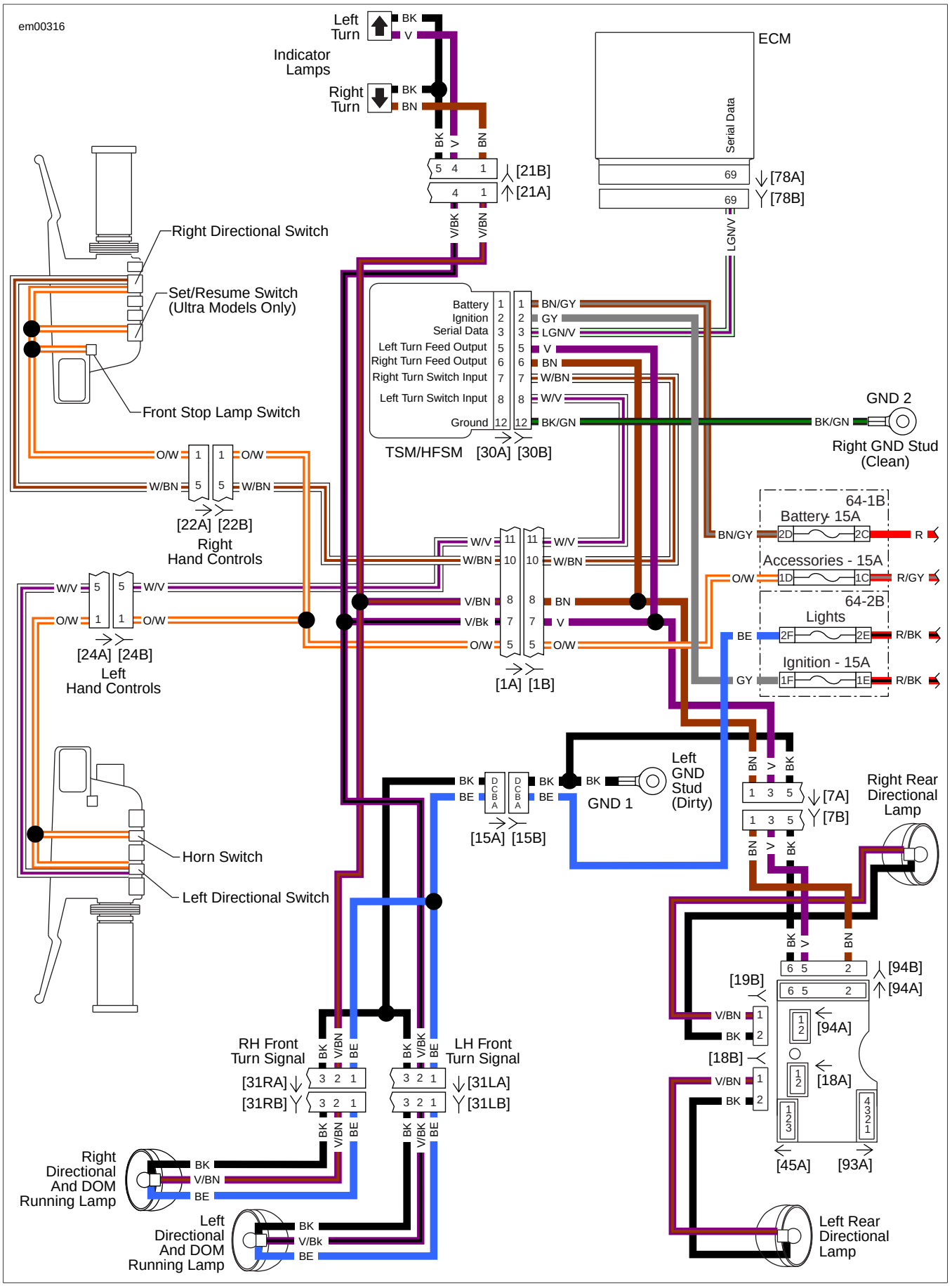


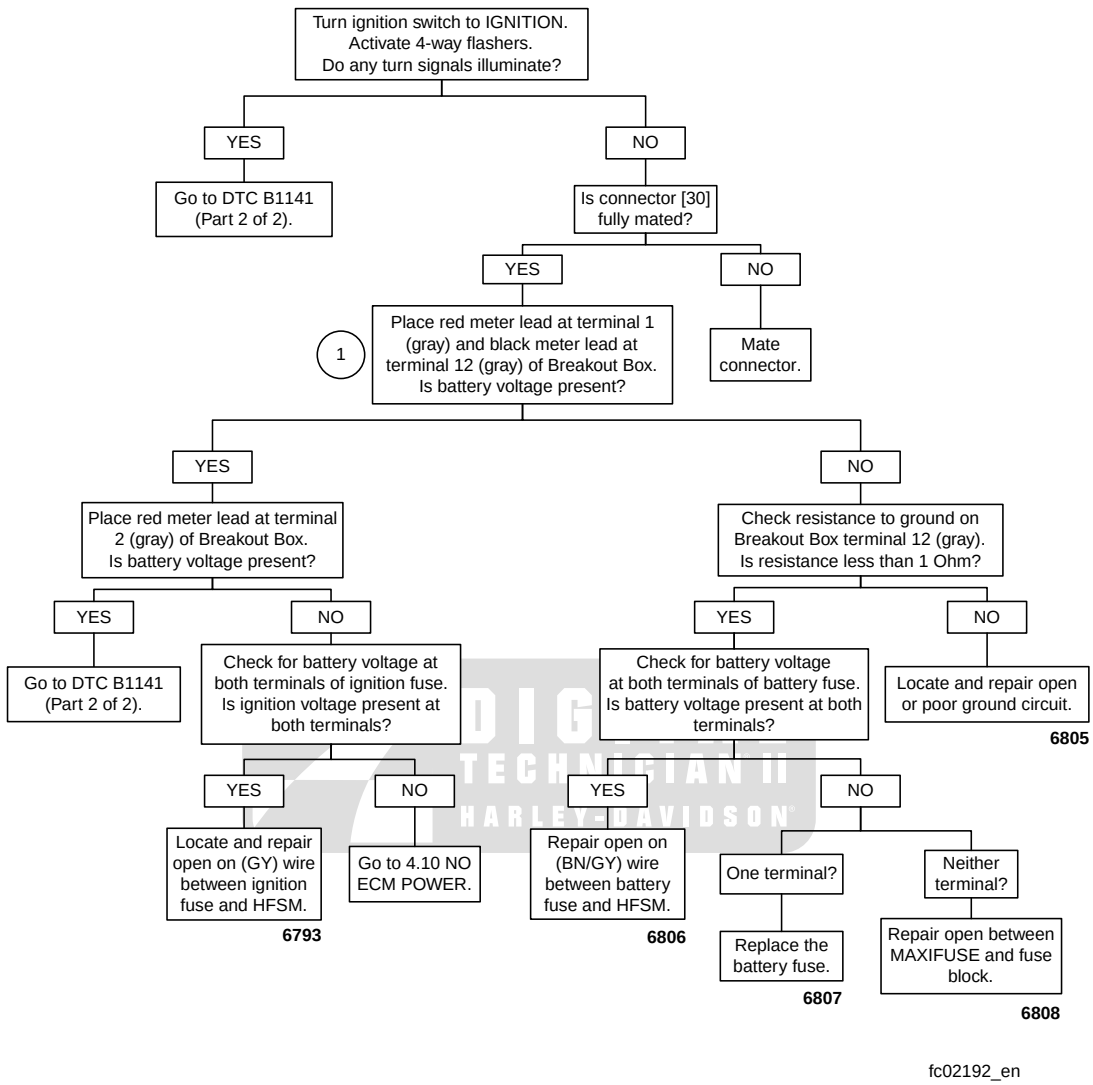
Figure 3-25. Turn Signal Circuit (FLHX, FLHT/C/U, FLTR)

Table 3-18. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHX, FLHT/C/U	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side below radio
[7]	Rear fender lights harness	All	8-place Multilock	Top of rear fender (under seat)
[15]	Main to interconnect harness	FLHX, FLHT/C/U	4-place Packard	Inner fairing - right fairing bracket
		FLTR	4-place Packard	Inner fairing - below radio (right side)
[18]	Left rear turn signal	All	2-place Multilock	Circuit board under tail lamp assembly
[19]	Right rear turn signal	All	2-place Multilock	Circuit board under tail lamp assembly
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[21]	Indicator lamps	FLHR/C	8-place Deutsch	Under console
		FLHX, FLHT/C/U	10-place Multilock	Inner fairing (above radio)
		FLTR	10-place Multilock	Inside instrument Nacelle
[22]	Right handlebar switches	FLHR/C	6-place Molex (Black)	Inside headlamp nacelle - fork stem nut lock plate (right side)
		FLHX, FLHT/C/U	12-place Molex (Black)	Inner fairing - right fairing support bracket
		FLTR	12-place Molex (Black)	Left side radio bracket
[24]	Left handlebar switches	FLHR/C	8-place Molex (Gray)	Inside headlamp nacelle - fork stem nut lock plate (left side)
		FLHX, FLHT/C/U	16-place Molex (Gray)	Inner fairing - left fairing support brace
		FLTR	16-place Molex (Gray)	Left side radio bracket
[30]	TSM/HFSM	All	12-place Deutsch	Under right side cover
[31]	Left/right front turn signal/auxiliary lamp	FLHR/C	6-place Multilock	Inside headlamp nacelle - fork stem nut lock plate (left side)
		FLHX, FLHT/C/U/FLTR	4-place Multilock	Inner fairing - left/right fairing support bracket
[33]	Ignition switch	FLHR/C	3-place Packard	Under console
		FLHX, FLHT/C/U/FLTR	3-place Packard	Bottom of ignition switch
[78]	ECM	All	73-place Packard	Under seat
[94]	Rear fender lights harness in circuit board	All	6-place Multilock	Circuit board under tail lamp assembly
[222]	Main to ignition harness	FLHR/C	4-place Packard	Under seat
[GND1] [GND1A] [GND2]	Harness grounds	All	Ring terminals	Under seat

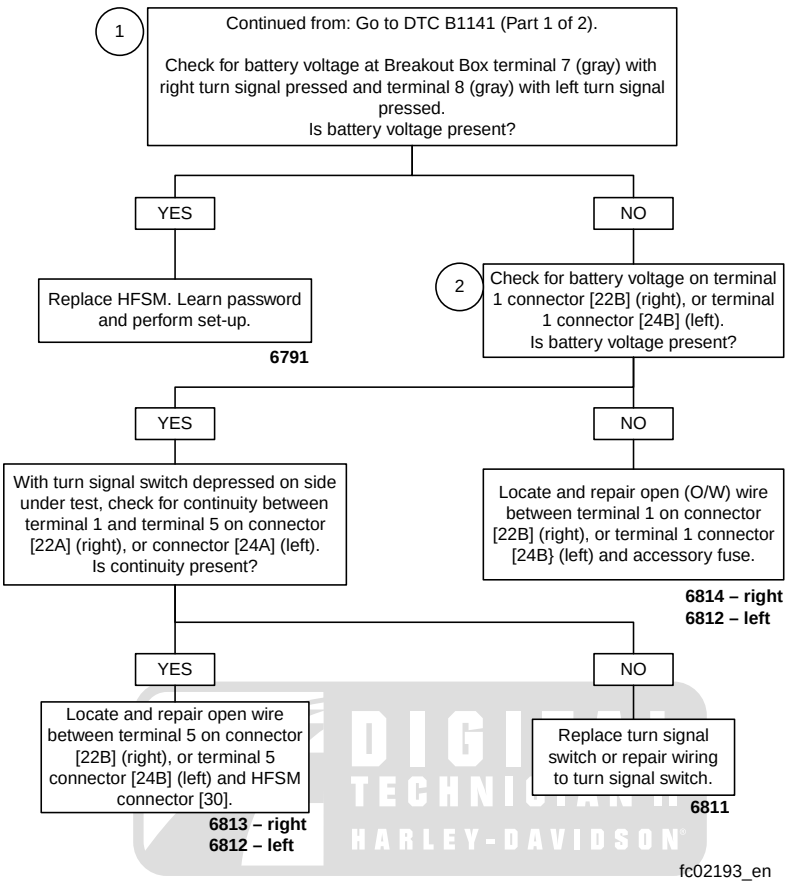
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1141 (Part 1 of 2)



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DTC B1141 (Part 2 of 2)



DTC B1143, B1144, B1145 (HFSM ONLY) 3.21

GENERAL

DTCs B1143, B1144, and B1145 set when faults occur to the security antenna circuit used to transmit to the fob. Refer to Table 3-19.

Table 3-19. Security Antenna DTCs

DTC	CONDITION	START WITH FLOWCHART
B1143	Security antenna short-to-ground	DTCs B1143, B1144, and B1145
B1144	Security antenna short-to-battery	DTCs B1143, B1144, and B1145
B1145	Security antenna open	DTCs B1143, B1144, and B1145

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Use black male HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) adapters and patch cords to connector [208B].
2. If DTC is current (lamp on continuously, cleared codes return during operation), replace HFSM. If DTC is historic, check for intermittents.
3. Connect light blue male HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) adapters and patch cords to connector [209B], and black male HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) adapters and patch cords to connector [208B].

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

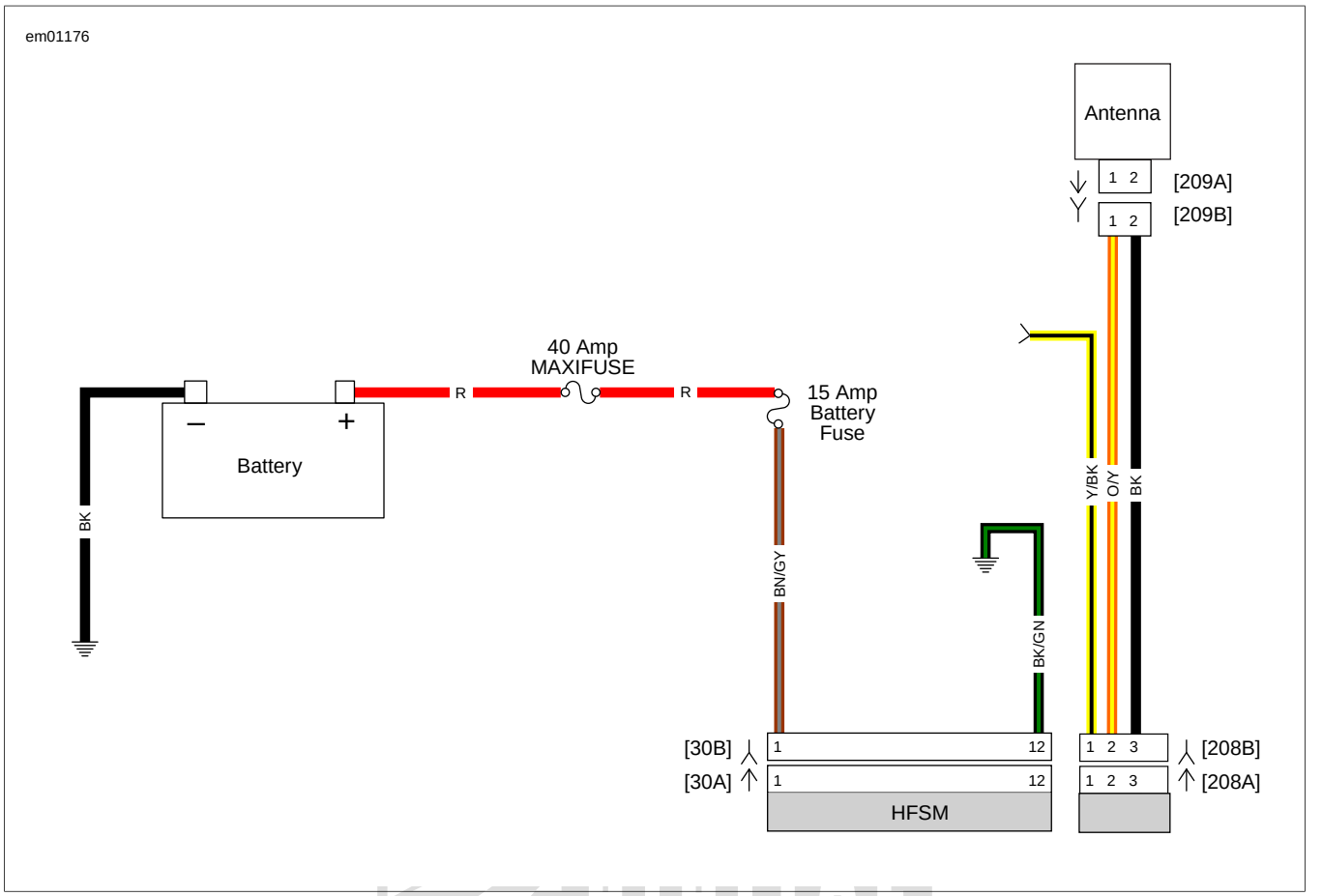
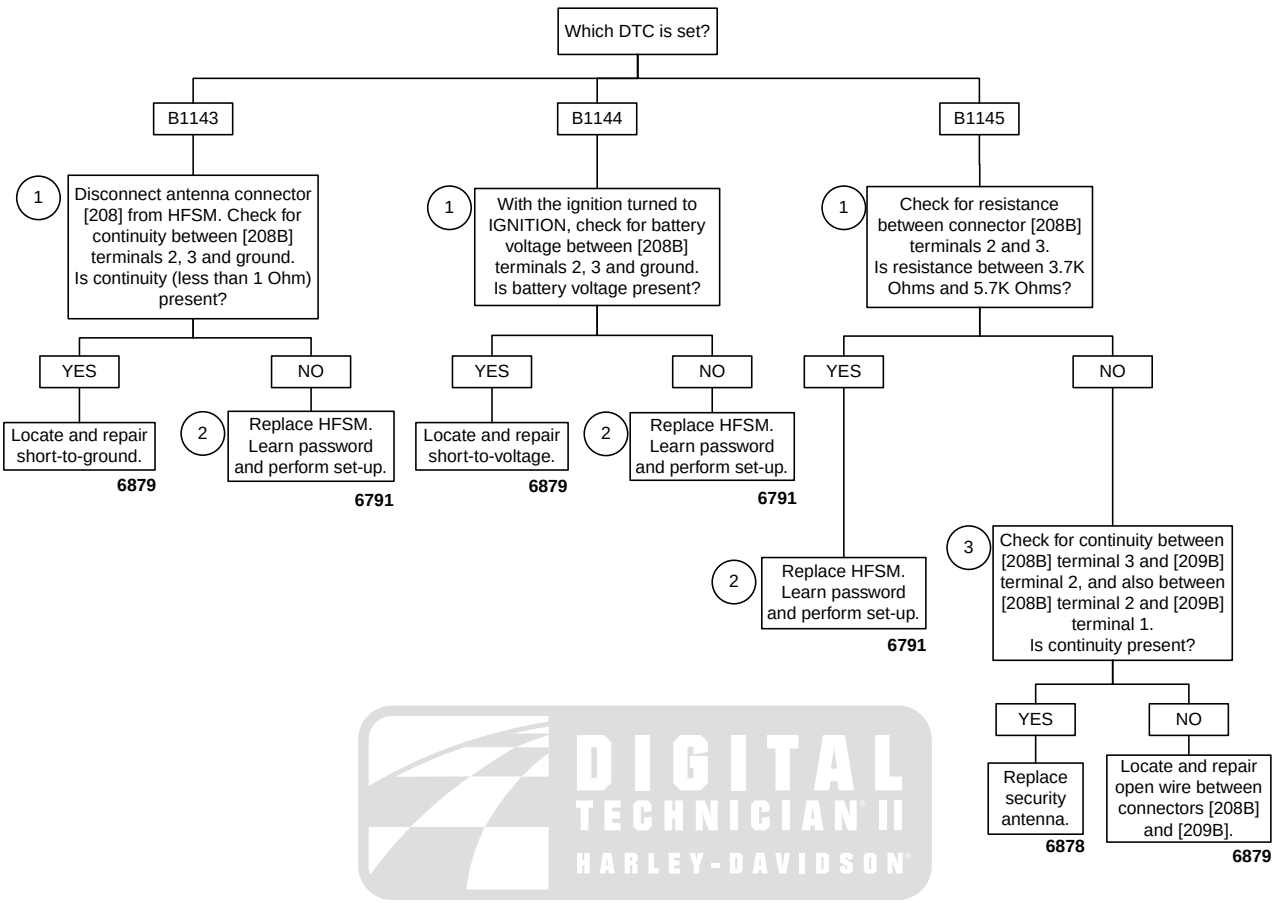


Figure 3-26. Security Antenna Circuit

Table 3-20. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[30]	HFSM	12-place Deutsch	Under right side cover
[208]	HFSM antenna jumper harness	4-place Deutsch	Under right side cover
[209]	HFSM antenna	2-place Molex	Under seat

DTCs B1143, B1144, and B1145



DIGITAL TECHNICIAN II HARLEY-DAVIDSON

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DTC B1151, B1152, B1153 3.22

GENERAL

Sidecar Bank Angle Sensor (BAS)

These DTCs set when a TSM/HFSM is configured for sidecar use and a fault is detected with the sidecar BAS.

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-48650	DIGITAL TECHNICIAN II

Diagnostic Tips

- The smart siren cannot be disarmed when the ignition switch is turned to IGNITION and a BAS is installed. If the ignition switch triggers the security alarm, then the switch must be turned off to disarm the siren.
- Use DIGITAL TECHNICIAN II (Part No. HD-48650) to verify sidecar learn.
- Verify no other circuits are tied to terminal 11 of the TSM/HFSM.
- If a sidecar is installed without the BAS kit, the TSM/HFSM continues to operate in solo mode on a sidecar motorcycle.
- If the BAS is removed without disabling sidecar learning, the TSM/HFSM sets a DTC until sidecar learning is disabled using DIGITAL TECHNICIAN II (Part No. HD-48650), or the BAS is reinstalled.
- The software is designed to prevent the TSM/HFSM from switching to sidecar mode unless the entire system is operating properly (no DTCs set).
- The BAS cannot be detected when the security function is in the alarm mode (lights flashing, siren sounding).
- A sidecar tip-over event cannot be detected when the security function is in the alarm mode (lights flashing, siren sounding).
- A short to ground fault cannot be detected when the security function is in the alarm mode (lights flashing, siren sounding).
- A short to battery fault cannot be detected **unless** the security function is in the alarm mode (lights flashing, siren sounding).
- An out-of-range fault cannot be detected when the security function is in the alarm mode (lights flashing, siren sounding).

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Use BREAKOUT BOX (Part No. HD-42682) and HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord. See 3.12 BREAKOUT BOX: TSM/HFSM.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord.

Table 3-21. Sidecar Bank Angle Sensor (BAS) DTCs

DTC	DESCRIPTION	START WITH FLOWCHART
B1151	Bank Angle Sensor Short to Ground	DTCs B1151, B1152, and B1153
B1152	Bank Angle Sensor Short to Battery	DTCs B1151, B1152, and B1153
B1153	Bank Angle Sensor Open	DTCs B1151, B1152, and B1153

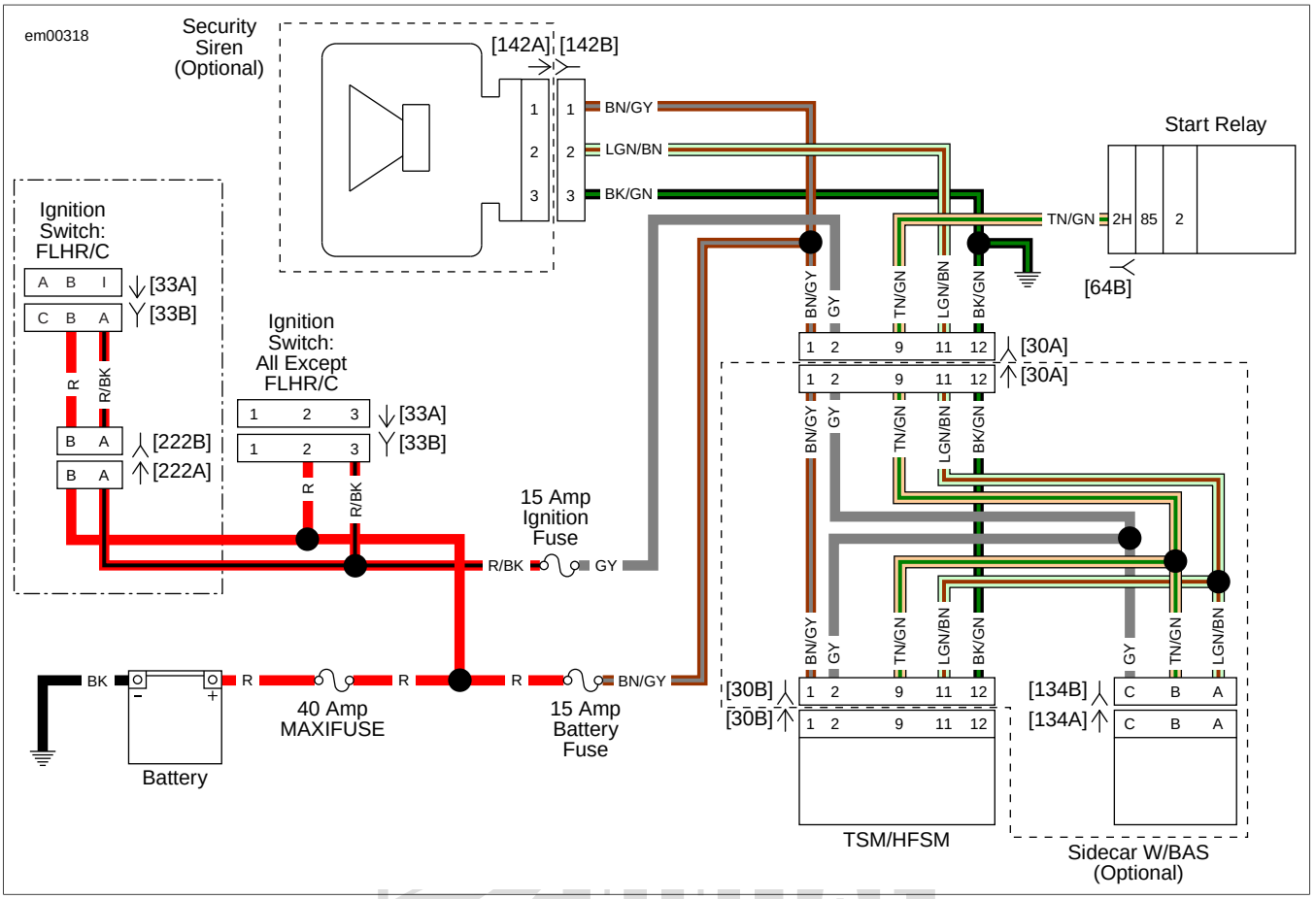
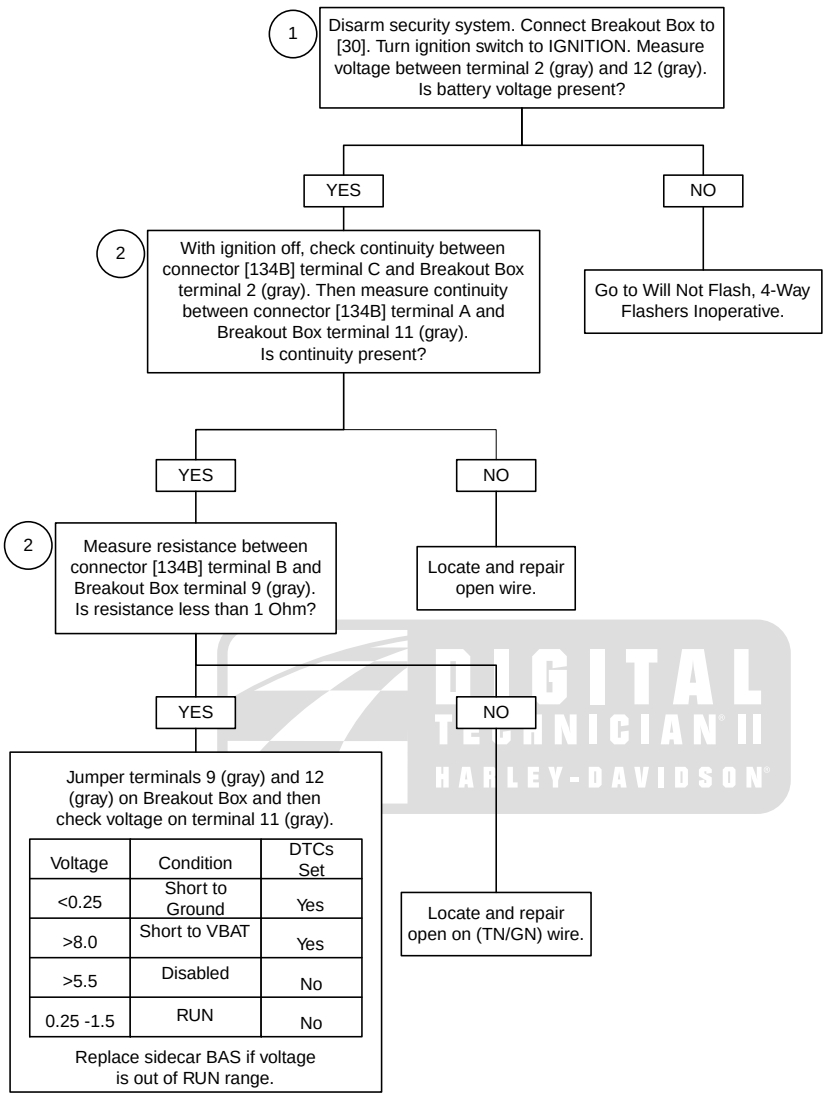


Figure 3-27. Siren Circuit

Table 3-22. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[30]	HFSM	12-place Deutsch	Under right side cover
[33]	Ignition switch	3-place Packard	Bottom of ignition switch on FLHX, FLHT/C/U and FLTR Under console on FLHR/C
[64]	Fuse block	Packard	Under left side cover
[134]	Sidecar BAS	4-place Deutsch	Under right side cover
[142]	Security siren	3-place Packard	Under left side cover
[222] (FLHR/C only)	Main to ignition harness	4-place Packard	Rear of fuel tank

DTCs B1151, B1152, and B1153



Clear DTCs using speedometer self-diagnostics. See 3.11 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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DTC B1154, B1155 3.23

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

Diagnostic Tips

DTCs B1154 and B1155 set when either the clutch switch circuit or neutral switch circuit is shorted to ground at speeds greater than 10 MPH (16 km/h) for more than 60 seconds. Refer to Table 3-23.

Table 3-23. Clutch/Neutral Switch DTCs

DTC	SYMPTOM
B1154	Clutch switch short-to-ground
B1155	Neutral switch short-to-ground

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) to HFSM. See 3.12 BREAKOUT BOX: TSM/HFSM.
2. If DTC is current (lamp on continuously, clear codes return during operation), replace HFSM. If DTC is historic, check for intermittents.
3. A reading of several hundred Ohms is normal due to the neutral indicator lamp (LED).

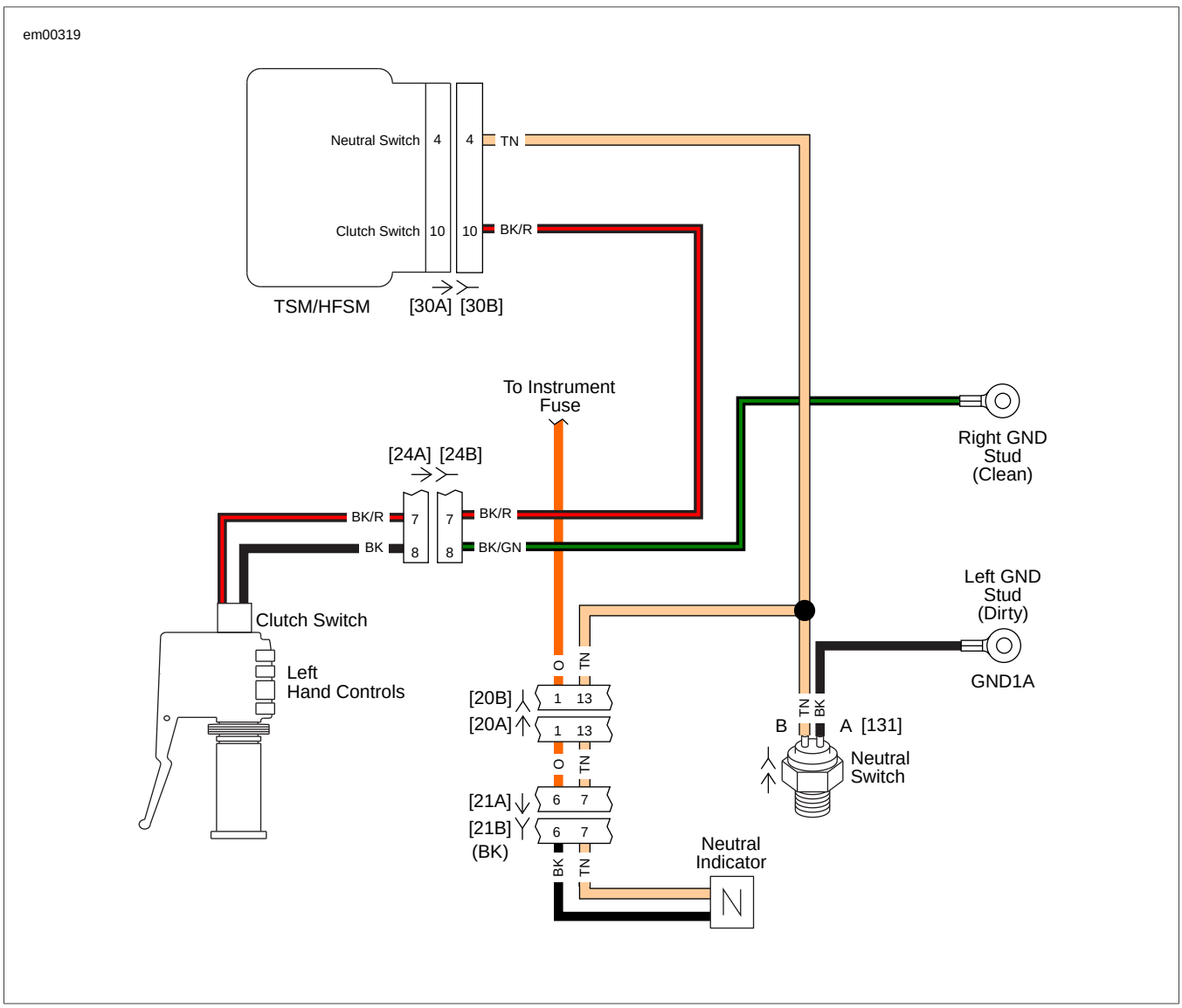


Figure 3-28. Clutch and Neutral Interlock Circuits (FLHR/C)

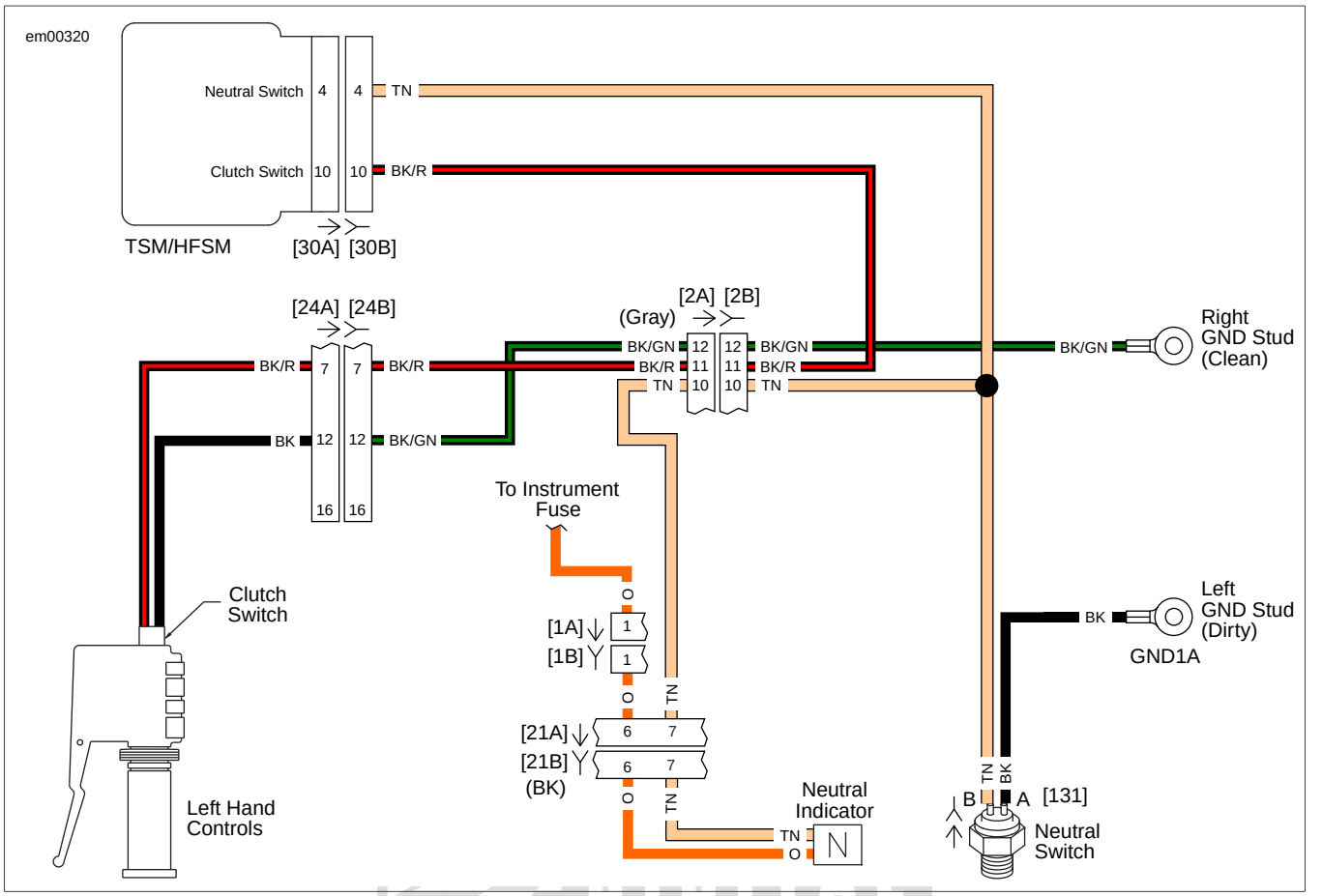


Figure 3-29. Clutch and Neutral Interlock Circuits (FLHX, FLHT/C/U, FLTR)

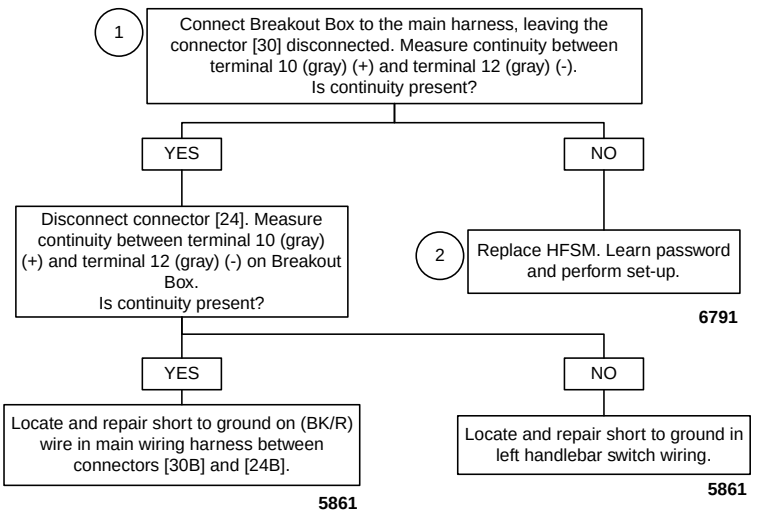
Table 3-24. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[2]	Main to interconnect harness	FLHX, FLHT/C/U, FLTR	12-place Molex (Gray)	Inner fairing - left radio support bracket
[21]	Indicator lamps	FLHR/C	8-place Deutsch	Under console
		FLHX, FLHT/C/U/FLTR	10-place Multilock	Inner fairing (above radio), inside instrument nacelle on FLTR
[24]	Left handlebar switches	FLHR/C	8-place Molex (Gray)	Inside headlamp nacelle - fork stem nut lock plate (left side)
		FLHX, FLHT/C/U/FLTR	16-place Molex (Gray)	Inner fairing - left fairing support brace
[30]	TSM/HFSM	All	12-place Deutsch	Under right side cover
[131]	Neutral switch	All	Post Terminals	Top of transmission (right side)

NOTE

DTCs B1154 and B1155 may occur if the vehicle is ridden with clutch disengaged (pulled in) at speeds greater than 10 MPH (16 km/h) for more than 60 seconds (coasting down a long mountain road).

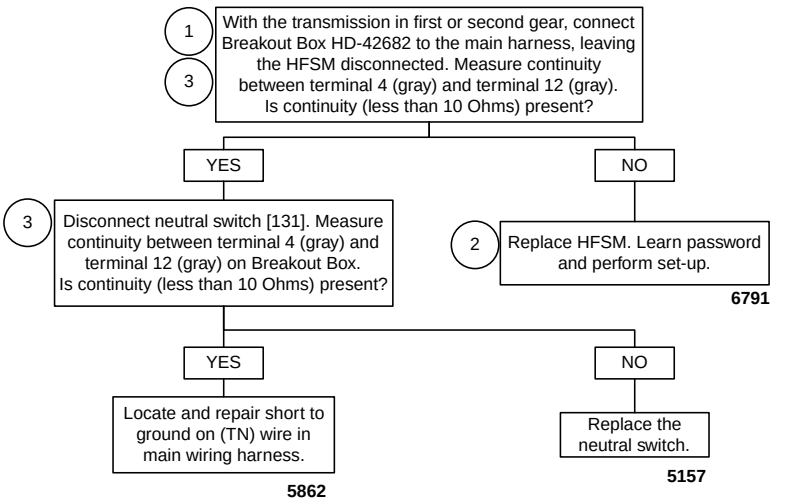
DTC B1154



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DTC B1155



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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC U1016 3.24

GENERAL

The DLC provides a means for the ECM, TSM/HFSM, ABS, and speedometer to communicate their current status. When all operating parameters on the serial data bus are within specifications, a state of health message is sent between the components. DTC U1016 indicates the ECM is not capable of sending this state of health message. DTC U1016 indicates there was communication on the data bus since power up, but communication was lost or interrupted during that key cycle.

Table 3-25. Code Description

DTC	CONDITION	START WITH FLOWCHART
U1016	Loss of all ECM serial data	DTC U1016

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/HFSM connector [30A] and wire harness connector [30B]. See 3.12 BREAKOUT BOX: TSM/HFSM.
2. Connect BREAKOUT BOX (Part No. HD-48637) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

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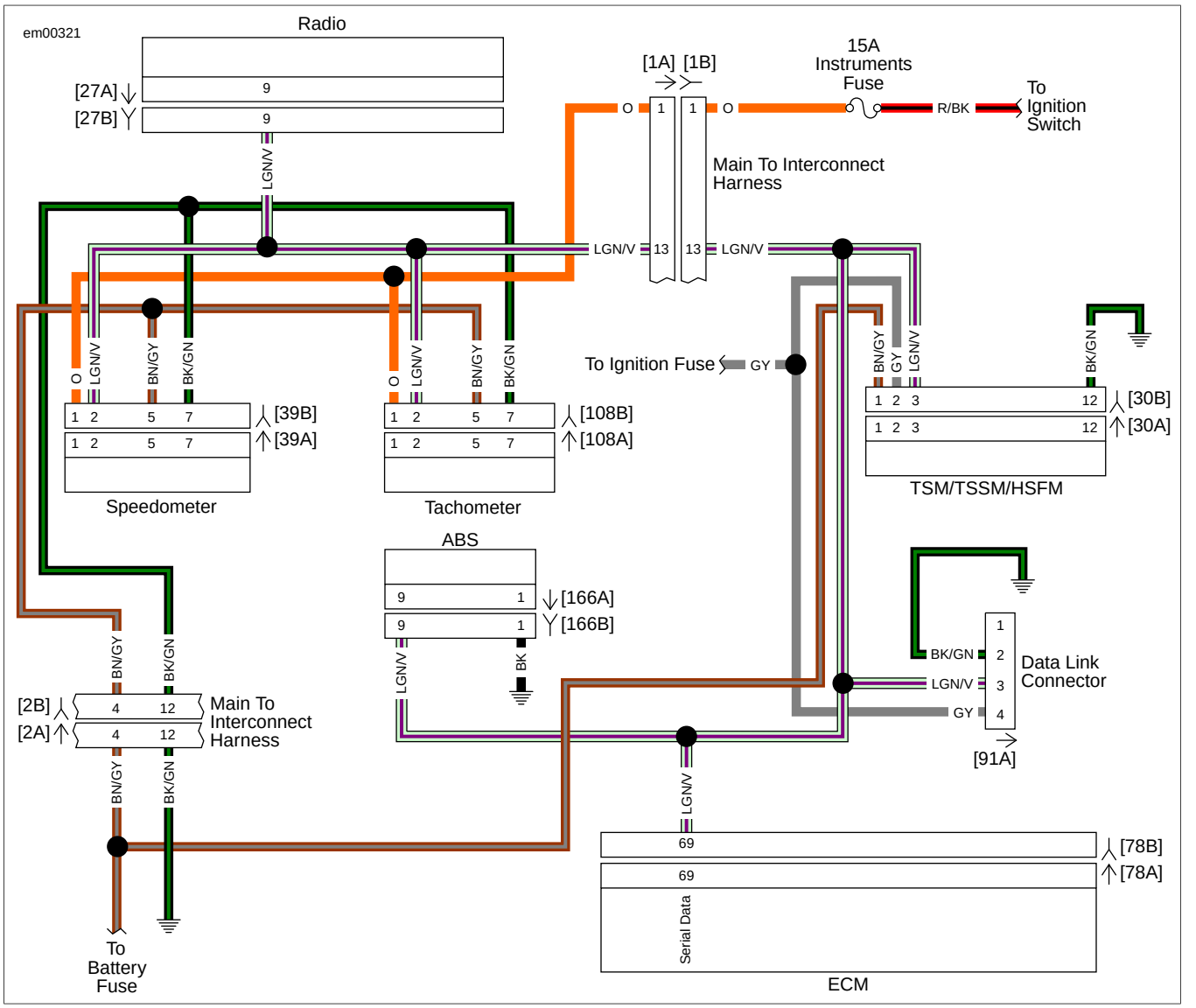


Figure 3-30. Serial Data Circuit: FLHX, FLHT/C/U, FLTR

Table 3-26. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHX, FLHT/C/U	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side below radio
[2]	Main to interconnect harness	All	12-place Molex (Gray)	Inner fairing - right radio support bracket
[27]	Radio	All	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[30]	TSM/HFSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHX, FLHT/C/U	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
[78]	ECM	All	73-place Packard	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover

Table 3-26. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[108]	Tachometer	FLHX, FLHT/C/U	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)
[166]	ABS module	All	12-place Molex	Under right side cover

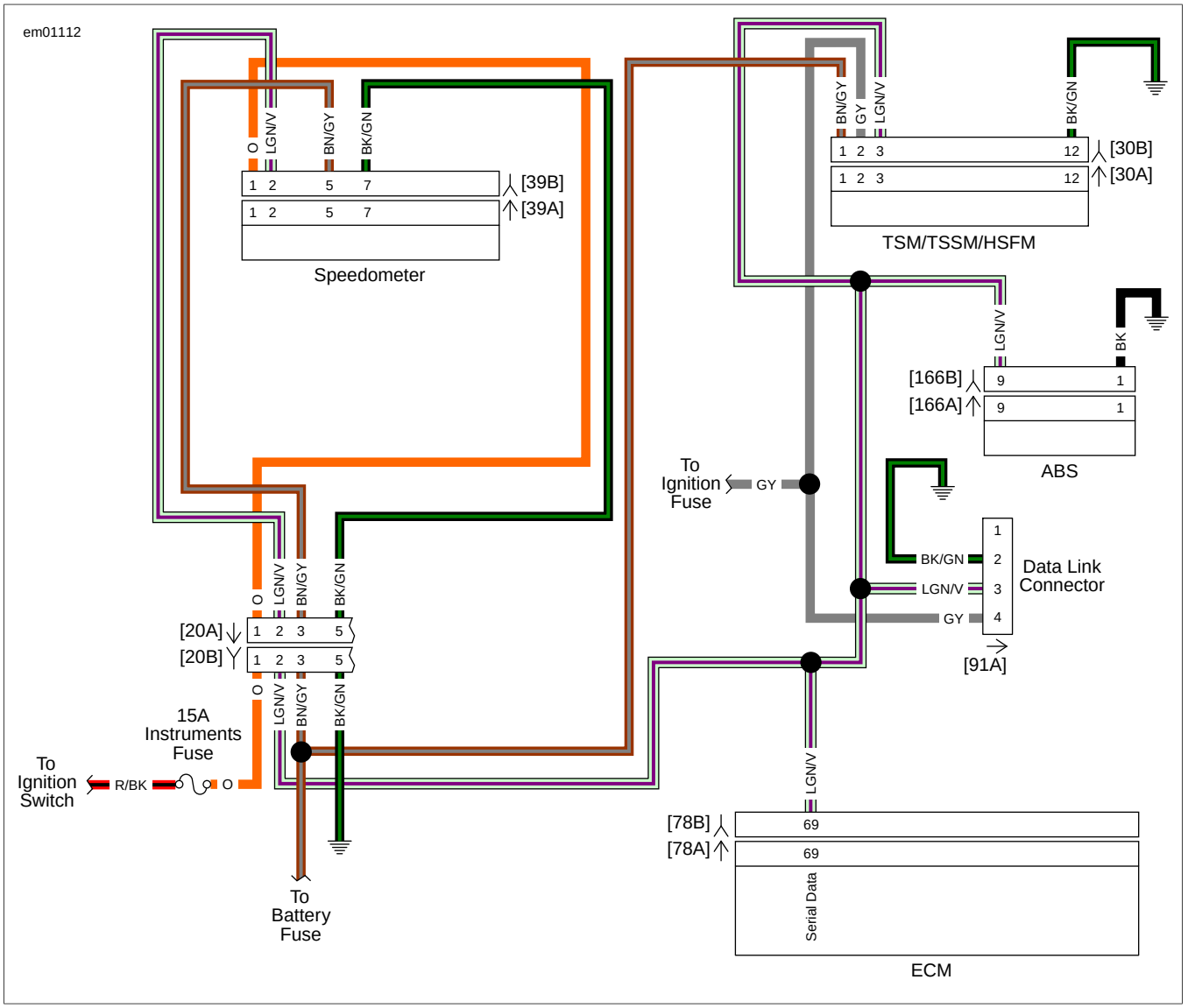


Figure 3-31. Serial Data Circuit: FLHR/C

Table 3-27. Wire Harness Connectors

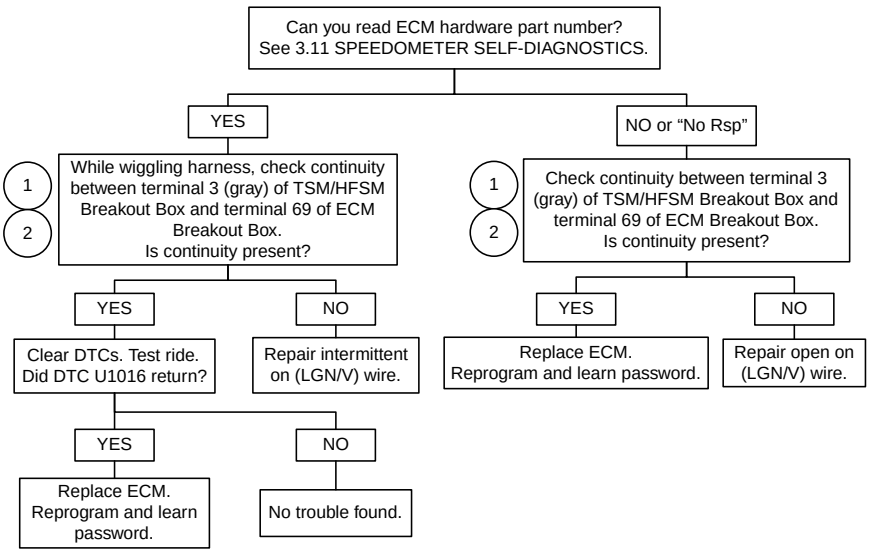
NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	16-place Molex	Under seat
[30]	TSM/HFSM	12-place Deutsch	Under right side cover

Table 3-27. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[39]	Speedometer	12-place Packard	Back of speedometer (back of console)
[78]	ECM	73-place Packard	Under seat
[91]	DLC	4-place Deutsch	Under left side cover
[166]	ABS module	20-place Molex	Under right side cover

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC U1016



Clear codes using speedometer self-diagnostics. See 3.11 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC U1300, U1301 OR BUS ER 3.25

DIAGNOSTICS

The typical serial data voltage range is 0 (inactive) to 7 Volts (active). Due to the short pulse, voltage is much lower on a DVOM. In analog mode, a DVOM reading serial data will show continuous voltage when active, typically 0.6-0.8 Volt. The range for acceptable operations is 0-7.0 Volts.

Diagnostic Tips

- If serial data is shorted, these DTCs automatically cause the check engine lamp to illuminate. The odometer reads BUS Er in this condition.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.

Diagnostic Notes

If a U1300, U1301 or BUS Er is present, perform diagnostic procedures listed in 4.11 STARTS, THEN STALLS.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TSM/HFSM: PASSWORD LEARN 3.26

GENERAL

If the ECM or TSM/HFSM is faulty, follow the instructions in the service manual for ECM or TSM/HFSM replacement. To determine if password learn is necessary, refer to Table 3-28.

Table 3-28. Password Learn

DEVICE REPLACED	IS PASSWORD LEARN NECESSARY?
ECM	Yes
TSM	No *
TSM/HFSM	Yes
* If a TSM has been replaced by a HFSM, or a HFSM has been replaced by a TSM, password learn is necessary.	

PASSWORD LEARNING

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

To perform password learning procedure, refer to Table 3-29. When finished, continue with all instructions under 3.3 H-DSSS ACTUATION.

Always perform all appropriate instructions under 3.3 H-DSSS ACTUATION after TSM/HFSM replacement or removal.

NOTE

Fob assignment must be performed at an authorized Harley-Davidson dealer using DIGITAL TECHNICIAN II (Part No. HD-48650).

Table 3-29. Setting TSM/HFSM and ECM Password

NO.	ACTION	CONFIRMATION	NOTES
	Ignition must be turned off for at least 15 seconds.	With ignition switch turned off, check engine lamp and security lamp will be off.	
1	Install **new** TSM/HFSM or ECM. Perform all steps under 3.3 H-DSSS ACTUATION.		
2	Set engine stop switch to **RUN.**		
3	Turn ignition switch to IGNITION	Verify check engine lamp and security lamp illuminate and then turn off.	TSM/HFSM enables start relay.
4	Attempt normal start one time.	Engine starts and stalls. Check engine lamp illuminates and stays on.	Password has not been learned. ECM sets DTC P1009.
5	Wait ten seconds. Security lamp illuminates and stays on.	Security lamp illuminates.	ECM enters Password Learning mode for ten minutes. Do not cycle ignition switch or interrupt vehicle power or Password Learn will be unsuccessful.
6	Wait until security lamp turns off.		This takes ten minutes.
7	Quickly (within one second) turn ignition switch OFF-IGNITION.		ECM must not be allowed to shutdown.
8	Wait until security lamp turns off.		This takes ten minutes.
9	Quickly (within one second) turn ignition switch OFF-IGNITION.		ECM must not be allowed to shutdown.
10	Wait until security lamp turns off.		This takes ten minutes.
11	Quickly (within one second) turn ignition switch OFF-IGNITION.		ECM must not be allowed to shutdown.
12	Turn ignition switch off. Wait 15 seconds before turning ignition switch on. Turn ignition switch on and start engine to confirm successful Password Learn procedure. Clear DTCs.		
13	Perform all steps under 3.3 H-DSSS ACTUATION.		

HFSM MAINTENANCE 3.27

GENERAL

The HFSM uses a battery in the fob and siren. These are the only parts requiring periodic maintenance.

HANDS-FREE FOB

Schedule

Replace the fob battery every year.

Battery Replacement

1. See Figure 3-32. Open the fob case.
 a. Place a thin blade in the thumbnail slot (1) between the two halves of the case.
 b. Slowly twist the blade.
2. Replace battery (2).
 a. Remove the original battery.
 b. Install a **new** battery with the positive (+) side down. Use a Panasonic® 2032 or equivalent.
3. With O-ring (3) in place, align case halves and snap case halves together.



1. Thumbnail slot
2. Battery (Panasonic 2032)
3. O-ring

Figure 3-32. Open Fob: HFSM

SMART SIREN (IF INSTALLED)

Schedule

The siren's internal 9 volt battery is rechargeable and does not need to be replaced on a regular basis. Battery life under normal conditions is approximately three to six years.

NOTES

- *See Figure 3-33 and Figure 3-34. Early style siren works with both TSSM and HFSM. Late style siren only works with HFSM.*
- *The internal siren battery may not charge if the motorcycle's battery is less than 12.5 Volts.*

Battery Replacement: Early Style Siren

1. Disarm system and remove siren.
2. See Figure 3-33. Remove battery cover.
 a. Place the siren module on a flat and sturdy table with the potted section (area with epoxy covering circuit board) facing up and towards you.
 b. Position a knife blade at a 45 degree angle to the long side of the siren case. Insert the knife blade between the siren case and battery cover at one of the two accessible corners of the battery cover. Keep the blade slightly higher towards the battery cover as this helps keep the blade away from the battery seal.
 c. Slowly twist the blade towards the battery cover and the cover will pop off.

NOTES

- *For protection against corrosion, battery terminals and battery clip are covered with a special grease. Do not wipe away this substance. Apply all available existing grease to terminals on new battery.*
- *Only a 9 Volt nickel metal hydride battery should be used in the siren.*

3. Replace battery by removing old battery from polarized battery clip. Install a **new** 9 Volt nickel metal hydride battery.
4. Reinstall battery cover.
 a. Carefully replace the rubber seal.
 b. Align battery cover with case placing round corners on cover away from connector [142A]. Snap cover into place.
5. Install siren and check operation. If siren is working properly, it responds with two chirps after receiving the arm command.

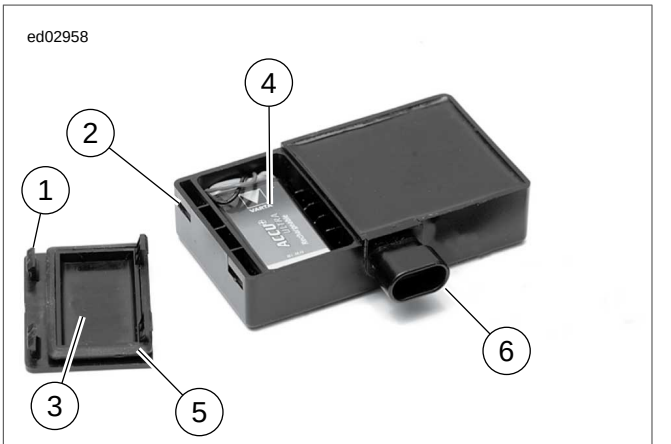
Battery Replacement: Late Style Siren

1. Disarm system and remove siren.
2. See Figure 3-34. With a small screwdriver or pick, push the catches (1) in through the two slots (2) in the end of the siren to release the battery cover (3).

NOTES

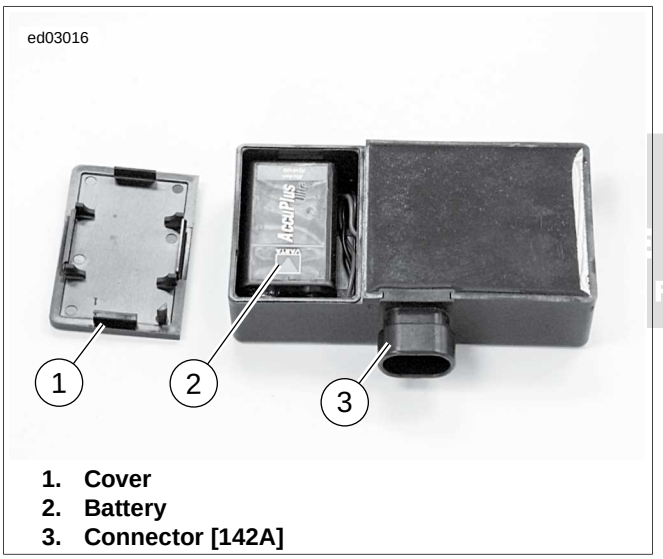
- *For protection against corrosion, battery terminals and battery clip are covered with a special grease. Do not wipe away this substance. Apply all available existing grease to terminals on new battery.*
- *Only a 9 Volt nickel metal hydride battery should be used in the siren.*

3. Replace battery (4) by removing old battery from polarized battery clip.
4. Recharge and re-install or install a **new** 9 Volt nickel metal hydride battery.
5. Reinstall battery cover (3).
 a. Carefully replace the rubber seal (5) on the cover.
 b. Align battery cover with case placing round corners on cover away from connector [142A] (6).
 c. Snap cover into place.
6. Install siren and check operation. If siren is working properly, it responds with two chirps after receiving the arm command.



1. **Catch**
2. **Slot**
3. **Cover**
4. **9 Volt battery**
5. **Rubber seal**
6. **Connector [142A]**

Figure 3-34. Siren Battery Compartment (Late Style Siren)



1. **Cover**
2. **Battery**
3. **Connector [142A]**

Figure 3-33. Battery Compartment (Early Style Siren)

IGITAL
CHNICIAN II
RLEY-DAVIDSON

NOTES

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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

SPECIFICATIONS 4.1

SPECIFICATIONS

General

The following specifications are provided as general electrical information for ignition components, and fuse/relay information. See Figure 4-1 for location of fuses and relays.

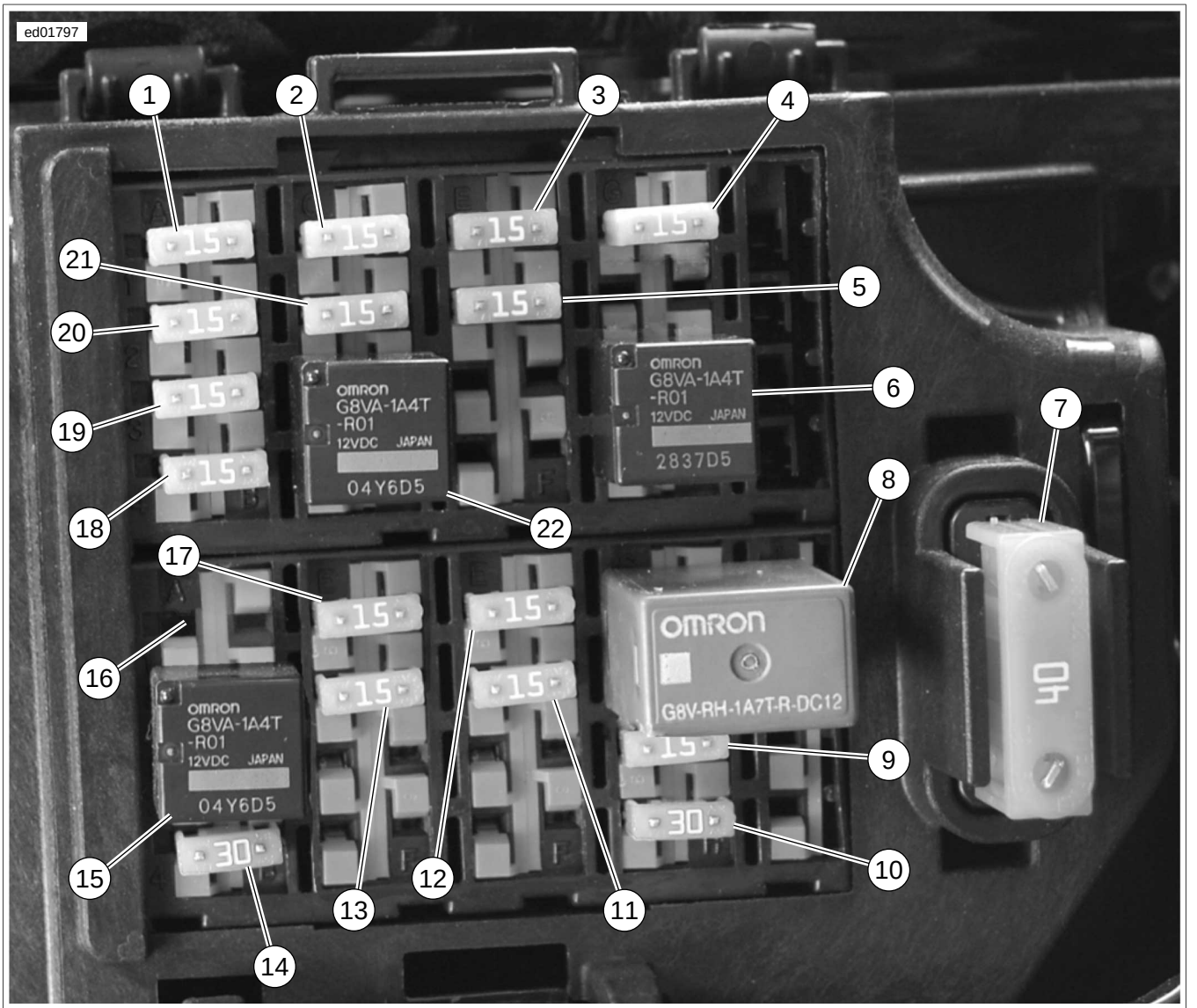
Table 4-1. General Specifications

IGNITION	DATA
Spark timing advance	-4° - 45° BTDC (range) 12° - 24° BTDC @1000 RPM
Idle speed	1000 ± 50 RPM
Spark plug size	12 mm
Spark plug gap	0.038-0.043 in 0.97-1.09 mm
Spark plug type	Harley-Davidson No. 6R12 (no substitute)
Ignition coil primary resistance	0.3-0.5 ohms
Ignition coil secondary resistance	2500-3500 ohms

Table 4-2. Fuse Ratings

ITEM NO.	PROTECTED (SYSTEM) CIRCUIT RELAY	RATING (AMPS)	COLOR
1	Brake/Cruise	15A	Blue
2	Accessory	15A	Blue
3	P&A	2A (Max)	--
4	Radio power/Siren	15A	Blue
5	ECM power	15A	Blue
6	Start relay	--	--
7	MAXIFUSE	40A	Orange
8	Lighting relay	--	--
9	Spare	15A	Blue
10	Spare	30A	Green
11	Lights	15A	Blue
12	Ignition	15A	Blue
13	Headlamp	15A	Blue
14	ABS	30A	Green
15	Brake relay	--	--
16	P&A IGN	15A	Blue
17	Instruments	15A	Blue
18	Fuel pump	15A	Blue
19	Exhaust control	15A	Blue
20	Radio memory	15A	Blue
21	Battery	15A	Blue
22	System relay	--	--

DIGITAL TECHNICIAN HARLEY-DAVIDSON



1. Brake/cruise
2. Accessory
3. P&A
4. Radio power/Siren
5. ECM power
6. Start relay
7. MAXIFUSE
8. Lighting relay
9. Spare
10. Spare
11. Lights
12. Ignition
13. Headlamp
14. ABS
15. Brake relay
16. P&A IGN (2A Max)
17. Instruments
18. Fuel pump
19. Exhaust control
20. Radio memory
21. Battery
22. System relay

Figure 4-1. Fuse and Relay Locations

EFI SYSTEM 4.2

GENERAL

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

See Figure 4-2. The engine management system consists of the following components:

- Electronic Control Module (ECM)
- Crank Position (CKP) sensor
- Temperature/Manifold Absolute Pressure (TMAP) sensor
- Engine Temperature (ET) sensor
- Twist Grip Sensor (TGS)
- Throttle Control Actuator (TCA)
- Vehicle Speed Sensor (VSS)
- Oxygen (O2) sensors
- Active exhaust actuator (HDI only)
- Ignition coil
- Fuel pump
- Fuel injector
- Purge solenoid

The ECM is a solid state device mounted under the seat and sealed to prevent contamination from dust/dirt, water and oil. The ECM controls engine performance based upon input supplied to the ECM from the ET, CKP, TMAP, TGS, O2 and the VSS sensors and other additional low-voltage circuits and components between the battery and ignition coil.

- The ECM controls the dwell time for the ignition coil, providing optimum ignition circuit performance for all engine speeds/load conditions. Optimizing the ignition system allows the ECM to control/vary engine timing (as needed) from 0-50° BTDC.
- The ECM also has built-in protection against transient voltages, continuous reverse voltages and inadvertent damage resulting from jump starts. The ECM is a non-repairable item and must be replaced when it fails.

The CKP sensor is located in the front left side of the crankcase. The CKP generates an AC signal that is sent to the ECM where it is used to reference engine position (TDC) and speed. It functions by taking readings off the 30 teeth on the left side flywheel (two teeth are missing to establish a reference point).

The TMAP sensor is a dual-purpose sensor, mounted in the top of the intake manifold. One portion is used to measure temperature and the other portion is used to measure the air pressure inside the intake manifold. The temperature part of the TMAP contains a thermistor element, used to measure the temperature of the air entering the intake manifold. The MAP portion of this sensor is used to measure the difference between atmospheric pressure and vacuum pressure, within the intake manifold. The ECM processes information from the TMAP (and other sensors) to adjust ignition timing and fuel to achieve optimum engine performance.

The ET sensor contains a thermistor element that varies the sensor's internal electrical resistance. As the engine temperature changes the resistance in the ET sensor changes. The ECM monitors this resistance to compensate for various operating conditions.

The TGS, mounted on the right hand side of the handlebar, houses two internal (opposing) Hall-effect sensors for operator control of the engine's throttle. The opposing operation of the sensors ensures that repositioning of the throttle twist grip, forward and/or back, is accurately reported to the ECM. As the throttle is operated, position changes are reported to the ECM that controls the corresponding movement of the throttle plate by the TCA.

The TCA, mounted to the intake manifold, operates the throttle plate internal to the induction module on the throttle engine. Two corresponding TP sensors receive input from the ECM, corresponding to the position of the TGS, to adjust the position of the throttle plates, accordingly. The ECM incorporates an H-Bridge and WatchDog microprocessor, used as safety devices, to control inadvertent or unexpected operations/conditions of the TCA and TGS.

The VSS is mounted in the transmission, beneath the starter motor. The VSS is a Hall-effect sensor, used to monitor and report vehicle speed based upon a reference point on the 5th gear of the transmission. A 5.0 volt reference signal and common ground circuitry are provided to the VSS, from the ECM. The VSS communicates electrical pulses to the ECM, where vehicle speed is calculated and sent to the speedometer as a serial data message.

The O2 sensor diagnostic codes may be seen during the vehicle break-in period. The sensor diagnostic codes will not illuminate the check engine lamp for current or historic codes and will only be indicated by DIGITAL TECHNICIAN II (Part No. HD-48650) or speedometer self-diagnostics. If the diagnostic codes are reported during the break-in period, clear or ignore the code(s) until the break-in period is complete.

There are two O2 sensors, one mounted in each of the two exhaust pipes, to monitor the exhaust gas air/fuel mixture ratio. Each O2 sensor samples the exhaust oxygen content and provides specific resistance (across the sensor terminals) to the ECM. The ECM continuously adjusts the air/fuel mixture to maintain an optimal air/fuel mixture. When properly mixed, the O2 sensor voltage(s) will measure approximately 0.45 volt, each.

The active exhaust system (HDI only) uses an actuator valve located in the rear of the exhaust pipe that is connected via a cable. The valve position automatically adjusts to enhance engine performance.

The ignition coils, mounted rearward on the chassis beneath the fuel tank, provide high voltage output to the spark plugs. Each ignition coil is made up of a primary winding where low voltage input creates a high voltage spike in the collapsible field of the secondary winding. The front and rear coils are fired independently (one cylinder at a time - no waste spark system). The ignition coil contains an extra terminal where the ECM monitors the current of the secondary winding for knock detection and combustion diagnostics.

The fuel pump, mounted inside the fuel tank on the vehicle, is a submersible pump used to provide fuel to the fuel injectors. The fuel pump is protected by an in-line 15 amp replaceable fuse.

- When the ignition switch is in the IGNITION position and the engine stop switch is in the RUN position, the ECM grounds the system relay supplying voltage to the fuel pump.
- The fuel pump continues running during cranking and normal running operation, as long as the ECM is receiving input from the CKP sensor. If no CKP pulses are received, the ECM shuts off the system relay within 2 seconds after the ignition is turned on, the engine has stalled or immediately after the engine is shut off.
- The fuel pump contains a pressure regulator which maintains consistent fuel pressure to each of the fuel injectors. Excess fuel flow is bypassed into the fuel tank by the pressure regulator.

There are two fuel injectors mounted to the intake manifold. The ECM controls the injectors by actuating the injector solenoid enabling fuel to be metered through the injector and atomized into the intake manifold.

- The injectors are timed to the combustion cycle and are triggered sequentially. When the ECM determines that fuel is required, the ECM supplies a short duration ground to the fuel injector, which opens and releases fuel into the air intake manifold.
- The ECM grounds the system relay, which supplies voltage to the fuel injectors. Each injector is protected and grounded by the ECM, through a common point ground within the ECM.

The purge solenoid (working with the charcoal canister) allows the vapors to escape back into the throttle body. The purge solenoid is timed to the throttle position but is disabled at startup, low engine temperature, low engine speed or low vehicle speed. The power for the purge solenoid comes from the system relay. The ECM provides the path to ground to trigger the purge solenoid.

Heat Management System

To improve rider comfort on all stock Touring model motorcycles, an optional heat management system may be enabled through DIGITAL TECHNICIAN II (Part No. HD-48650). After being enabled, the heat management system improves rider comfort by turning off the rear cylinder fuel injector whenever the following conditions exist:

- High engine temperature
- Engine at idle speed
- Low vehicle speed
- Clutch lever pulled in or transmission in neutral

As the engine maintains idle speed, the rear cylinder functions as an "air pump," helping to cool the engine. This continues until one of the above listed conditions is no longer met, then the rear cylinder fires normally again.

When the engine is in heat management mode, a noticeable difference in idle may be accompanied by a unique exhaust odor. While these conditions are normal, a rider or technician unaware of the heat management system may incorrectly assume an idle problem is present.

Activating Engine Idle Temperature Management System (EITMS)

Upon request of the customer, reflash the ECM with the revised calibration using DIGITAL TECHNICIAN II (Part No. HD-48650). Review/explain the following system function to the customer.

Enable/Disable EITMS

1. Turn the ignition ON with the motorcycle at idle and not moving (the motorcycle may be running or not running).
2. Push the throttle to roll-off position and hold.
3. After approximately 3 seconds, the cruise indicator will flash either red (disabled) or green (enabled).
4. Repeat procedure to change.

TROUBLESHOOTING

See the diagnostic charts for troubleshooting information.

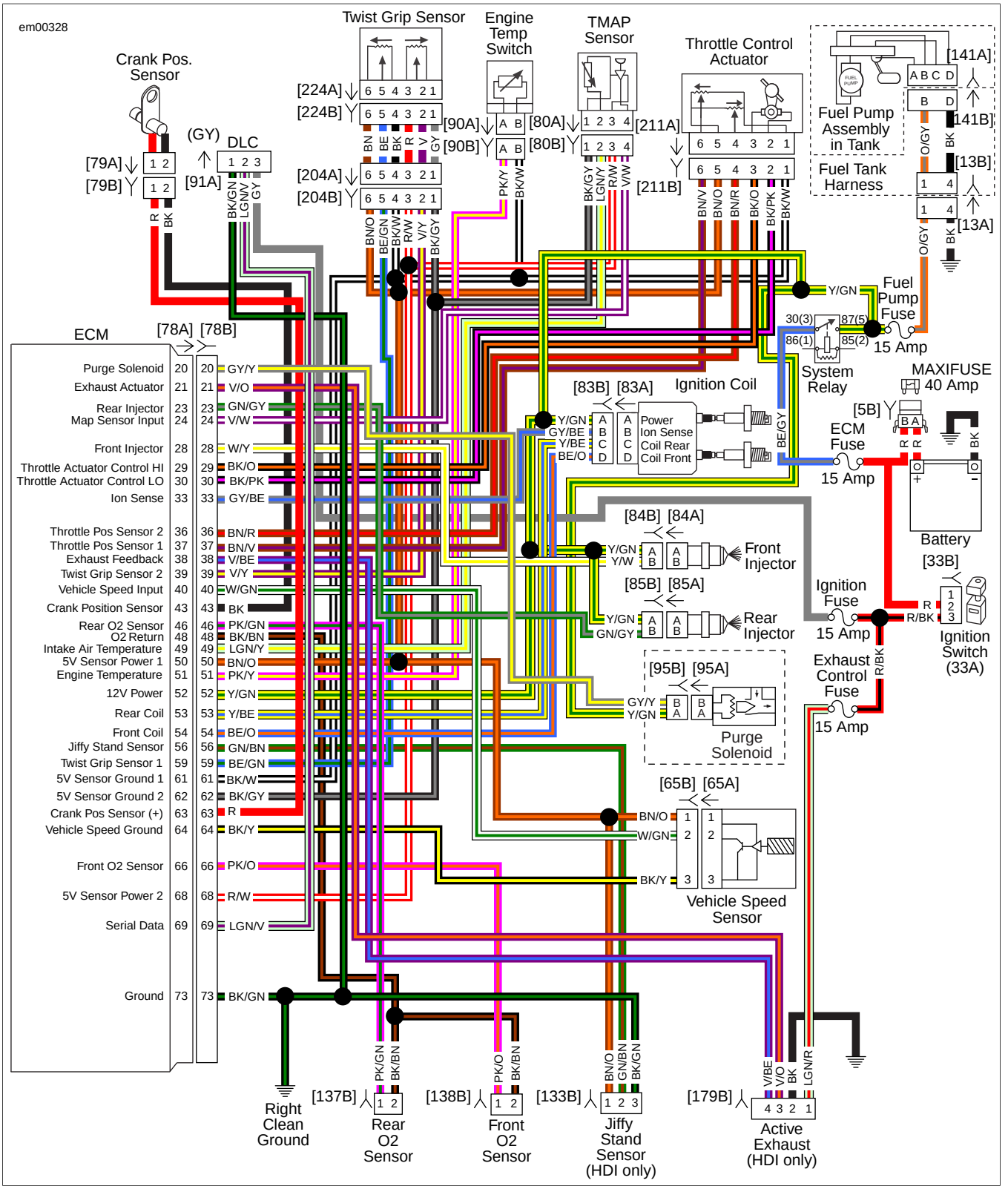


Figure 4-2. EFI Circuit (FLHX, FLHT/C/U, FLTR)

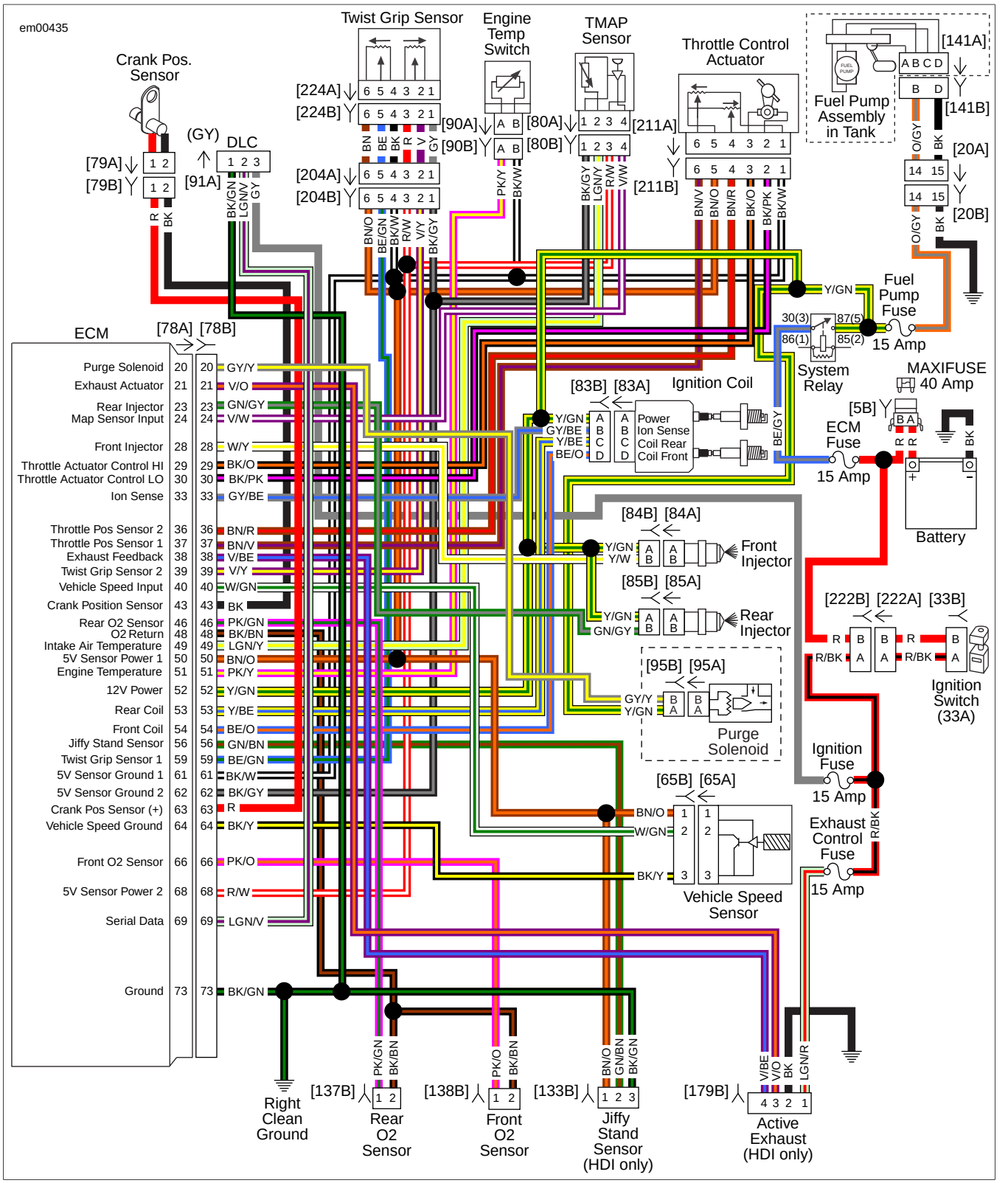


Figure 4-3. EFI Circuit (FLHR/C)

Table 4-3. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[13]	Fuel tank harness	All	4-place Multilock	Behind fuel tank (under seat)
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[33]	Ignition switch	FLHT/C/U/ FLTR	3-place Packard	Bottom of ignition switch housing
		FLHR/C	3-place Packard	Under console
[65]	VSS	All	3-place Delphi	Top of transmission case (under starter)
[78]	ECM	All	73-place Delphi	Under seat
[79]	CKP sensor	All	2-place Mini-Deutsch	Rear of lower front frame crossmember
[80]	TMAP sensor	All	4-place Delphi	Top of induction module
[83]	Ignition coil	All	4-place Delphi	Bottom front of battery tray
[84]	Front injector	All	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	All	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	All	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	All	4-place Deutsch	Under left side cover
[95]	Purge solenoid	All	2-place Delphi	Under seat
[133]	Jiffy stand sensor	All	3-place Molex (black)	Domestic (not used): Rear of lower front frame crossmember HDI: Rear of lower front frame cross-member
[137]	O2 sensor rear exhaust header	All	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	All	2-place Amp (Tyco)	Back of cross brace front frame downtubes
[141]	Fuel pump and fuel level sender	All	4-place Packard	Under console, on top of fuel tank canopy
[179]	Active exhaust actuator	All	5-place Amp (Tyco)	Domestic (not used): Under right side cover HDI: Under right side cover
[204]	TGS harness	FLTR	6-place Molex	Inner fairing right side below radio
		FLHT/C/U	6-place Molex	Inner right fairing support bracket
[211]	TCA	All	6-place Molex	Right side of engine (induction module)
[222]	Console ignition switch interconnect	FLHR/C	4-place Packard	Under seat
[224]	TGS	All	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)

DIGITAL TECHNICIAN HARLEY-DAVIDSON®

EFI DIAGNOSTIC INTRODUCTION 4.3

SYSTEM PROBLEMS

All system problems fall into at least one of three general categories.

No Start

The engine cranks over freely, but will not start. This does not include situations where the engine will not crank, such as a security disabled starter, or dead battery. This condition assumes that all obvious checks (such as fuel in tank) have been made.

Poor Performance

The engine starts but there are performance problems. These problems may include poor fuel economy, rough idle, engine misfire, engine hesitation, or severe spark knock.

Check Engine Lamp

See Figure 4-6. The check engine lamp indicates the ECM has determined a fault condition exists. There may also be starting or performance problems.

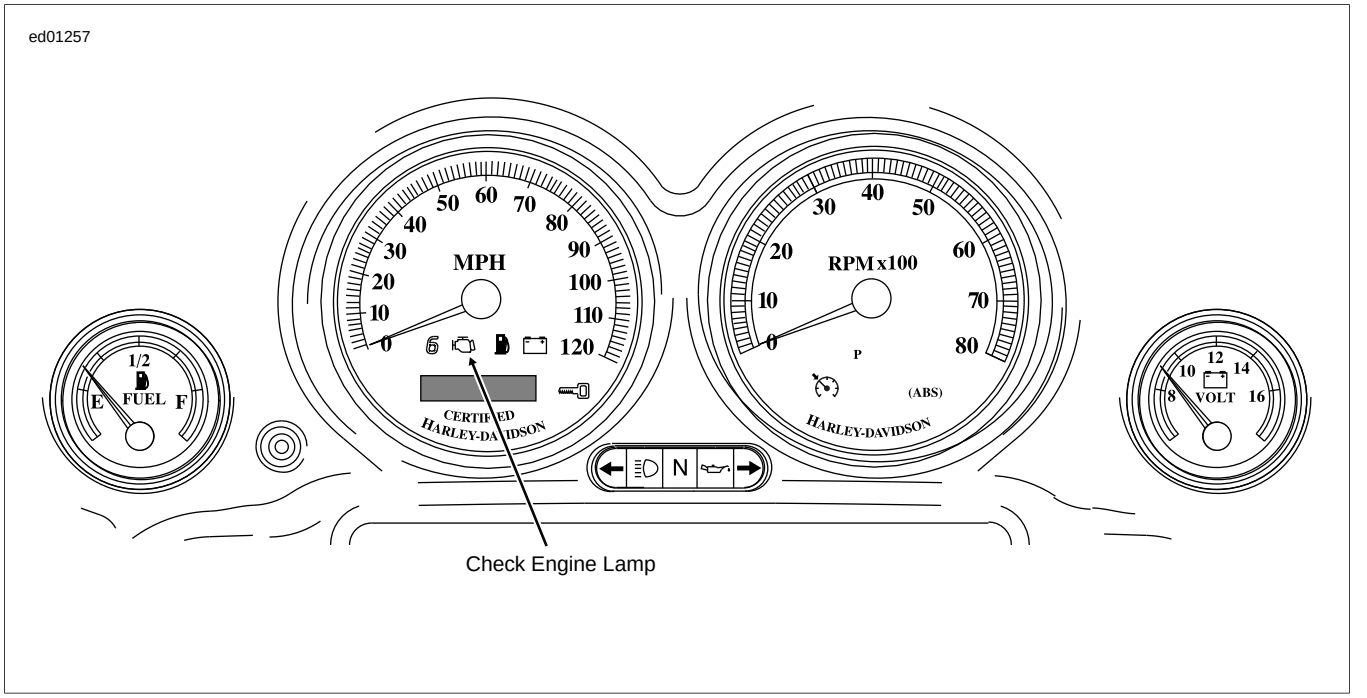


Figure 4-4. Speedometer

RESOLVING PROBLEMS

To resolve system problems, five basic steps are involved. In order of occurrence, they are:

1. Check for DTCs by using speedometer self-diagnostics. See 4.4 CHECKING FOR DIAGNOSTIC TROUBLE CODES: EFI.
2. Retrieve DTCs by using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTICS.
3. Diagnose system problems. This involves using special tools and the diagnostic flowcharts in this section.
4. Correct problems through the replacement and/or repair of the affected components.
5. After repairs are performed, validate the work. This involves clearing the DTCs and confirming proper vehicle operation as indicated by the lack of DTCs.

CHECKING FOR DIAGNOSTIC TROUBLE CODES: EFI 4.4

CHECK ENGINE LAMP

To diagnose system problems, start by observing the behavior of the check engine lamp.

NOTES

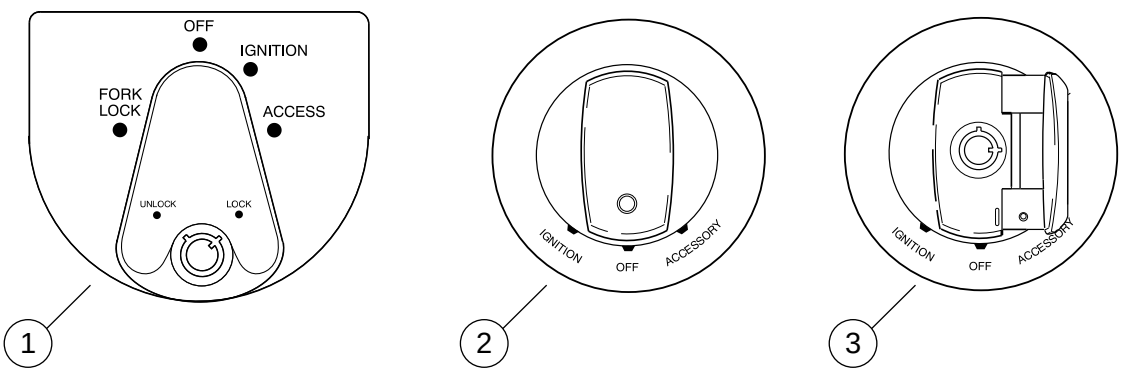
- *See Figure 4-5. The ignition switch is turned to IGNITION and the engine stop switch is set to RUN (although the engine is **not** running).*
- *When the ignition switch is turned to IGNITION, the check engine lamp will illuminate for approximately four seconds and then turn off.*
- *If the check engine lamp is not illuminated while in IGNITION position, or if it fails to turn OFF after the initial four-second period, then the speedometer may need to be replaced. See 4.5 INITIAL DIAGNOSTIC CHECK: EFI.*

1. See Figure 4-6. When the lamp turns off after being illuminated for the first four second period, it will:
 a. Remain off if there are no fault conditions or trouble codes currently detected by the ECM.
 b. Come back on for an eight second period if only historic codes exist.
 c. Come back on, and remain on, if a current trouble code exists.
2. See 4.4 CHECKING FOR DIAGNOSTIC TROUBLE CODES: EFI, Code Types for a complete description of DTC formats.

NOTE

Some DTCs can only be fully diagnosed during actuation. For example, a problem with the ignition coil will be considered a current fault even after the problem is corrected, since the ECM will not know of its resolution until after the coil is exercised by vehicle start sequence. In this manner, there may sometimes be a false indication of the current trouble code.

om00705a



1. **All except FLHR models**
2. **All FLHR models (cover shown closed)**
3. **All FLHR models (cover shown open)**

Figure 4-5. Ignition Switch: Touring Models

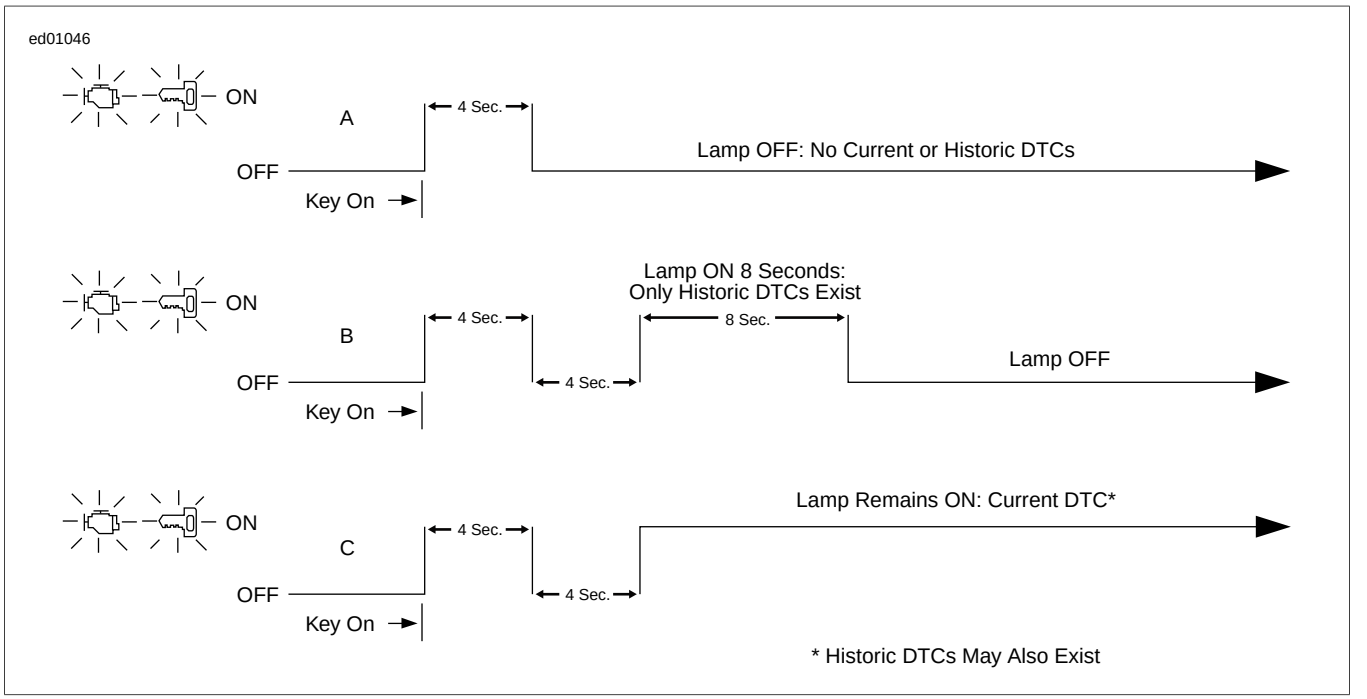


Figure 4-6. Check Engine Lamp Operation

CODE TYPES

There are two types of DTCs: current and historic. If a DTC is stored, it can be read using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTICS.

All DTCs reside in the memory of the ECM, TSM/TSSM/ HFSM, speedometer, ABS or tachometer until the DTC is cleared by use of the speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTICS.

A historic DTC is also cleared after a total of 50 trips has elapsed. A trip consists of a start and run cycle. After the 50 trip retention period, the DTC is automatically erased from memory providing that no subsequent faults of the same type are detected in that period.

Current

Current DTCs are those which are present during the current ignition cycle. See the appropriate flowcharts for solutions.

Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic code rather than a current code.

Historic codes are stored for a length of time to assist in the diagnosis of intermittent faults. See Figure 4-6. The check engine lamp will come back on for eight seconds to indicate the existence of only historic codes.

It is important to note that historic codes may also be present whenever the system indicates the existence of a current code. See 4.4 CHECKING FOR DIAGNOSTIC TROUBLE CODES: EFI, Multiple Diagnostic Trouble Codes if multiple DTCs are found.

Diagnostic charts are designed for use with current DTCs and as a result they frequently suggest part replacement. When diagnosing a historic code the charts can be helpful, but should not lead to part replacement without verification that a suspected component/part is faulty.

RETRIEVING DIAGNOSTIC TROUBLE CODES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The engine management system provides two levels of diagnostics.

- The most sophisticated mode employs a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650).
- The second mode requires using the speedometer self-diagnostics. Speedometer, ABS (if equipped), tachometer (if equipped), TSM/TSSM/HFSM and ECM DTCs can be accessed and cleared. See 4.6 SPEEDOMETER SELF-DIAGNOSTICS.

MULTIPLE DIAGNOSTIC TROUBLE CODES

While it is possible for more than one fault to occur and set more than one trouble code, there are several conditions which may result in one fault setting multiple trouble codes:

- The TMAP sensor, TGS, jiffy stand sensor and VSS are connected to the same reference line (+5 V Vref). If the reference line goes to ground or open, multiple codes can be set.
- Serial data codes (DTC U1300, U1301, U1016, U1064, and U1097) may be accompanied by other codes. **Always** correct the serial data codes first.

Refer to Table 4-8. This table gives most ECM DTCs a priority ranking.

INITIAL DIAGNOSTIC CHECK: EFI 4.5

GENERAL

PART NUMBER	TOOL NAME
HD-48637	BREAKOUT BOX
HD-48650	DIGITAL TECHNICIAN II

To locate faulty circuits or other system problems, follow the diagnostic flowcharts in this section. For a systematic approach, always begin with 4.5 INITIAL DIAGNOSTIC CHECK: EFI, Initial Diagnostics. Read the general information and then work your way through the flowchart box by box.

Diagnostic Notes

If a numbered circle appears adjacent to a flowchart box, then more information is offered in the diagnostic notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual where information on the location and removal of components may be obtained.

Circuit Diagram/Wire Harness Connector Table

When working through a flowchart, refer to the illustrations, the associated circuit diagram and the wire harness connector table as necessary. The wire harness connector table for each circuit diagram identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a BREAKOUT BOX (Part No. HD-48637) and a DVOM are required. See 4.7 BREAKOUT BOX: EFI.

To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Reprogramming ECM

Diagnostic charts frequently suggest ECM replacement. In the event an ECM needs to be replaced, it must be reprogrammed using a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650). See your dealer. Password learn procedure must also be performed. See 3.26 TSM/HFSM: PASSWORD LEARN.

INITIAL DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-46601	INSTRUMENT HARNESS ADAPTERS
HD-48637	BREAKOUT BOX

General Information

The diagnostic check is an organized approach to identifying a problem caused by an electronic control system malfunction.

Diagnostic Tips

- If speedometer reads "No Rsp" (no response) while in diagnostic mode, check data bus for an open or short to ground between DLC [91A] terminal 3 and ECM, TSM/TSSM/HFSM, speedometer or tachometer (if equipped), and ABS (if equipped). For more information on speedometer diagnostic mode, see 4.6 SPEEDOMETER SELF-DIAGNOSTICS.
- Check for an open diagnostic test terminal between DLC terminal 3 and ECM terminal 69. With ignition switch at IGNITION, transmit data should be typically 0.6-0.8 volt. The range of acceptable voltage is greater than 0.0 and less than 7.0 volts.
- If speedometer reads "BUS Er" (serial data bus error), refer to flowcharts in 2.5 BREAKOUT BOX: SPEEDOMETER/TACHOMETER.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Compare engine behavior to symptoms tables.
 a. Engine starts hard. Refer to Table 4-5.
 b. Hesitates, stumbles, surges, misfires and/or sluggish performance. Refer to Table 4-6.
 c. Engine exhaust emits black smoke or fouls plugs. Refer to Table 4-7.
2. Connect BREAKOUT BOX (Part No. HD-48637) and INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) between wire harness and speedometer. See 2.5 BREAKOUT BOX: SPEEDOMETER/TACHOMETER

All EFI DTCs are listed in Table 4-8.

Other Diagnostic Trouble Codes (DTCs)

See 3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM for any codes related to the TSM, TSSM or HFSM.

See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER for any codes related to the speedometer or tachometer.

See 6.4 INITIAL DIAGNOSTIC CHECK: ABS for any codes related to the Anti-lock Brake System (ABS).

Table 4-4. Typical Scan Values for Engine Data

ITEM	MIN. VALUE	MAX. VALUE	HOT IDLE
TMAP sensor	10.3 kPa	104 kPa	10.3-13.3 in. Hg (35-45 kPa)
	0 volt	5.1 volts	

Table 4-4. Typical Scan Values for Engine Data

ITEM	MIN. VALUE	MAX. VALUE	HOT IDLE
RPM	975	5,000 limited	1000
ET sensor	3° F (-16° C)	464° F (240° C)	230-300° F (110-150° C)
	0.0 volt	5.0 volts	0.5-3.23 volts
INJ PW front	0	50 mS	2-4 mSec
INJ PW rear	0	50 mS	2-4 mSec
Advance front	-4	45°	12-24°
Advance rear	-4	45°	12-24°
VSS	0	120	0 MPH
Battery voltage	10	15	14.5 volts
ENG RUN	OFF	RUN	RUN
Idle RPM	975	1450	975-1025

NOTE

Hot idle specifications are with stock exhaust, the engine operating at 1000 RPM and an engine temperature of approximately 260 °F (127 °C). Idle settings may be changed with the idle set procedure. See the service manual.

Table 4-5. Engine Starts Hard

SYMPTOM	SOLUTION
Battery discharged	See 1.7 CHARGING SYSTEM, Troubleshooting.
Spark plugs	4.14 MISFIRE AT IDLE OR UNDER LOAD.
Spark plug wires	4.14 MISFIRE AT IDLE OR UNDER LOAD.
Ignition coil	4.14 MISFIRE AT IDLE OR UNDER LOAD.
Valve sticking	See the service manual.
Contamination in fuel system	Drain and refill with fresh fuel.
Loss of battery power to ECM terminal 71*	4.10 NO ECM POWER.
* DTCs will not clear (although they appear to).	

Table 4-6. Engine Performance Problems

CAUSE	SOLUTION
Manifold leak	See the service manual.
TMAP sensor plugged or not operating properly	4.16 DTC P0107, P0108, P0112, P0113.
Contamination in fuel system	Drain and refill with fresh fuel.
Spark plugs	4.14 MISFIRE AT IDLE OR UNDER LOAD.
Low fuel pressure	See the service manual.

Table 4-7. Engine Exhaust Emits Black Smoke or Fouls Plugs

CAUSE	SOLUTION
Clogged air filter.	See Air Cleaner Filter in the service manual.
TMAP sensor plugged or not operating properly.	4.16 DTC P0107, P0108, P0112, P0113.
Purge solenoid or vent to evaporative canister not routed or operating properly.	4.22 DTC P0444, P0445.

Table 4-8. EFI DTCs and Fault Conditions

PRIORITY	DTC	FAULT CONDITION	SOLUTION
1	P0605	ECM FLASH Memory Error	4.28 DTC P0603, P0605
2	P0603	ECM EEPROM Memory Error	4.28 DTC P0603, P0605
3	U1300	ECM Serial Data Low	4.11 STARTS, THEN STALLS
4	U1301	ECM Serial Data High	4.11 STARTS, THEN STALLS
5	U1097	Loss of Speedometer Serial Data To ECM	4.46 DTC U1097
6	U1064	Loss of TSM/FSFM Serial Data To ECM	4.45 DTC U1064
7	P1003	System Relay Contacts Open	4.13 SYSTEM RELAY FAULT
8	P1002	System Relay Coil High/Shorted	4.13 SYSTEM RELAY FAULT
9	P1001	System Relay Coil Open/Low	4.13 SYSTEM RELAY FAULT
10	P1004	System Relay Contacts Closed	4.13 SYSTEM RELAY FAULT
11	P1009	Incorrect Password	4.30 DTC P1009, P1010
12	P1010	Missing Password	4.30 DTC P1009, P1010
13	P0641	5V +VRef 1 Out Of Range	4.29 DTC P0641, P0651
14	P0651	5V +VRef 2 Out Of Range	4.29 DTC P0641, P0651
15	P0373	CKP Sensor Intermittent	4.21 DTC P0373, P0374
16	P0107	MAP Sensor Open/Low	4.16 DTC P0107, P0108, P0112, P0113
17	P0108	MAP Sensor High	4.16 DTC P0107, P0108, P0112, P0113
18	P0374	CKP Sensor Synch Error	4.21 DTC P0373, P0374
19	P1600	EFI Module Processor - Internal Fault	4.37 DTC P1600
20	P1270	TGS Validation Error	4.31 DTC P1270
21	P2107	EFI Module Processor Internal Error	4.40 DTC P2107
22	P2122	TGS1 Low/Open	4.42 DTC P2122, P2123, P2127, P2128
23	P2123	TGS1 High	4.42 DTC P2122, P2123, P2127, P2128
24	P2127	TGS2 Low/Open	4.42 DTC P2122, P2123, P2127, P2128
25	P2128	TGS2 High	4.42 DTC P2122, P2123, P2127, P2128
26	P2138	TGS Correlation Error	4.43 DTC P2135, P2138
27	P0120	TPS1 Range Error	4.18 DTC P0120, P0122, P0123, P0220, P0222, P0223
28	P0220	TPS2 Range Error	4.18 DTC P0120, P0122, P0123, P0220, P0222, P0223
29	P0122	TPS1 Low	4.18 DTC P0120, P0122, P0123, P0220, P0222, P0223
30	P0123	TPS2 High/Open	4.18 DTC P0120, P0122, P0123, P0220, P0222, P0223
31	P0222	TPS2 Low	4.18 DTC P0120, P0122, P0123, P0220, P0222, P0223
32	P0223	TPS2 High/Open	4.18 DTC P0120, P0122, P0123, P0220, P0222, P0223
33	P2135	TPS Correlation Error	4.43 DTC P2135, P2138
34	P2119	EFI Motor Throttle Body Range Performance	4.41 DTC P2119

Table 4-8. EFI DTCs and Fault Conditions

PRIORITY	DTC	FAULT CONDITION	SOLUTION
35	P2100	EFI Motor Circuit Open	4.38 DTC P2100, P2101, P2102, P2103
36	P2101	EFI Motor Circuit Range Performance (Actuation Error)	4.38 DTC P2100, P2101, P2102, P2103
37	P2102	EFI Motor Circuit Low	4.38 DTC P2100, P2101, P2102, P2103
38	P2103	EFI Motor Circuit High	4.38 DTC P2100, P2101, P2102, P2103
39	P2176	EFI Closed Position Not Learned	4.44 DTC P2176
40	P1514	Air Flow Fault	4.36 DTC P1514
41	P2105	EFI Forced Engine Shutdown	4.39 DTC P2105
42	P1501	Jiffy Stand Sensor Low	4.34 DTC P1501, P1502
43	P1502	Jiffy Stand Sensor High	4.34 DTC P1501, P1502
44	P0572	Brake Switch Low	4.26 DTC P0572
45	P0117	ET Sensor Low	4.17 DTC P0117, P0118
46	P0118	ET Sensor High	4.17 DTC P0117, P0118
47	P0112	IAT Voltage Low	4.16 DTC P0107, P0108, P0112, P0113
48	P0113	IAT Voltage Open/High	4.16 DTC P0107, P0108, P0112, P0113
49	P1351	Front Ignition Coil Driver Open/Low	4.32 DTC P1351, P1352, P1354, P1355
50	P1354	Rear Ignition Coil Driver Open/Low	4.32 DTC P1351, P1352, P1354, P1355
51	P1352	Front Ignition Coil Driver High/Shorted	4.32 DTC P1351, P1352, P1354, P1355
52	P1355	Rear Ignition Coil Driver High/Shorted	4.32 DTC P1351, P1352, P1354, P1355
53	P1357	Front Cylinder Combustion Intermittent	4.15 COMBUSTION ABSENT/INTERMITTENT
54	P1358	Rear Cylinder Combustion Intermittent	4.15 COMBUSTION ABSENT/INTERMITTENT
55	P0261	Front Injector Open/Low	4.20 DTC P0261, P0262, P0263, P0264
56	P0263	Rear Injector Open/Low	4.20 DTC P0261, P0262, P0263, P0264
57	P0262	Front Injector High	4.25 DTC P0562, P0563
58	P0264	Rear Injector High	4.25 DTC P0562, P0563
59	P0562	Battery Voltage Low	4.25 DTC P0562, P0563
60	P0563	Battery Voltage High	4.25 DTC P0562, P0563
61	P0501	VSS Sensor Low	4.23 DTC P0501, P0502
62	P0502	VSS Sensor High/Open	4.23 DTC P0501, P0502
63	P1356	Rear Cylinder No Combustion	4.15 COMBUSTION ABSENT/INTERMITTENT
64	P1353	Front Cylinder No Combustion	4.15 COMBUSTION ABSENT/INTERMITTENT
65	P0505	Idle Speed Control	4.24 DTC P0505
66	P0444	Purge Solenoid Open/Low	4.22 DTC P0444, P0445
67	P0445	Purge Solenoid High	4.22 DTC P0444, P0445
68	P1475	Exhaust Actuation Position Error	4.33 DTC P1475, P1477, P1478
69	P1477	Exhaust Actuator Open/Low	4.33 DTC P1475, P1477, P1478
70	P1478	Exhaust Actuator Shorted/High	4.33 DTC P1475, P1477, P1478
71	P0131	Front Oxygen Sensor Low	4.19 DTC P0131, P0132, P0134, P0151, P0152, P0154
72	P0151	Rear Oxygen Sensor Low	4.19 DTC P0131, P0132, P0134, P0151, P0152, P0154
73	P0132	Front Oxygen Sensor High	4.19 DTC P0131, P0132, P0134, P0151, P0152, P0154
74	P0152	Rear Oxygen Sensor High	4.19 DTC P0131, P0132, P0134, P0151, P0152, P0154
75	P0134	Front Oxygen Sensor Inactive	4.19 DTC P0131, P0132, P0134, P0151, P0152, P0154
76	P0154	Rear Oxygen Sensor Inactive	4.19 DTC P0131, P0132, P0134, P0151, P0152, P0154
77	P1510	EFI Limited Performance Mode	4.35 DTC P1510, P1511, P1512

Table 4-8. EFI DTCs and Fault Conditions

PRIORITY	DTC	FAULT CONDITION	SOLUTION
78	P1511	EFI Power Management Mode	4.35 DTC P1510, P1511, P1512
79	P1512	EFI Forced Idle Mode	4.35 DTC P1510, P1511, P1512
80	P0577	Cruise Control Input High	4.27 DTC P0577

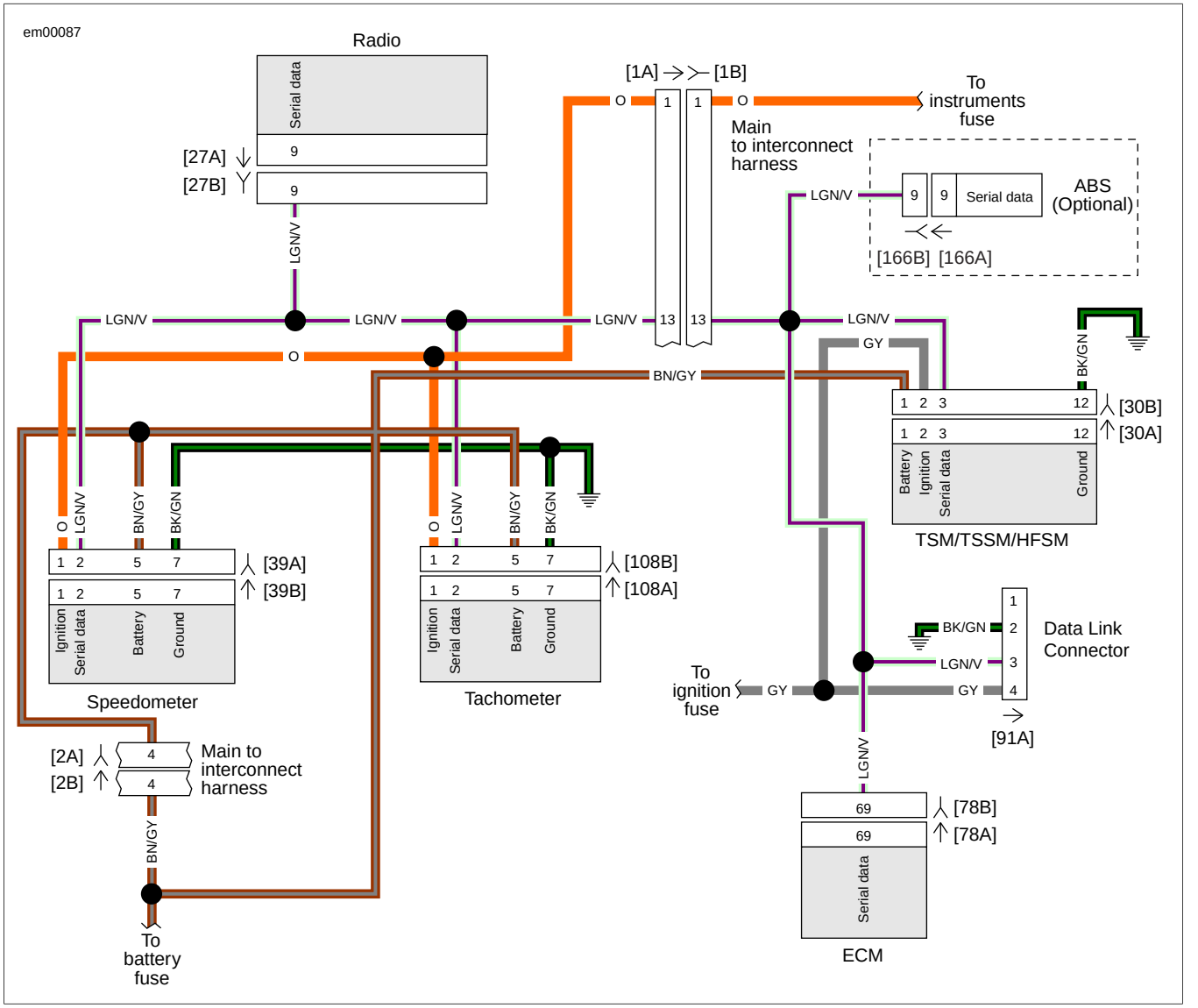


Figure 4-7. Diagnostic Check (FLHX, FLHT/C/U, FLTR)

Table 4-9. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - below radio (right side)

Table 4-9. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[2]	Main to interconnect harness	FLHT/C	12-place Molex (Gray)	Inner fairing - left fairing support bracket
		FLTR	12-place Molex (Gray)	Inner fairing - below radio (right side)
[27]	Radio	All	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[30]	TSM/HFSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHT/C	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Under bezel (back of speedometer)
		FLHR	12-place Packard	Back of speedometer (back of console)
[78]	ECM	All	73-place Packard	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover
[108]	Tachometer	FLHT/C	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)
[166]	ABS Module	All	20-place Molex	Under right side cover

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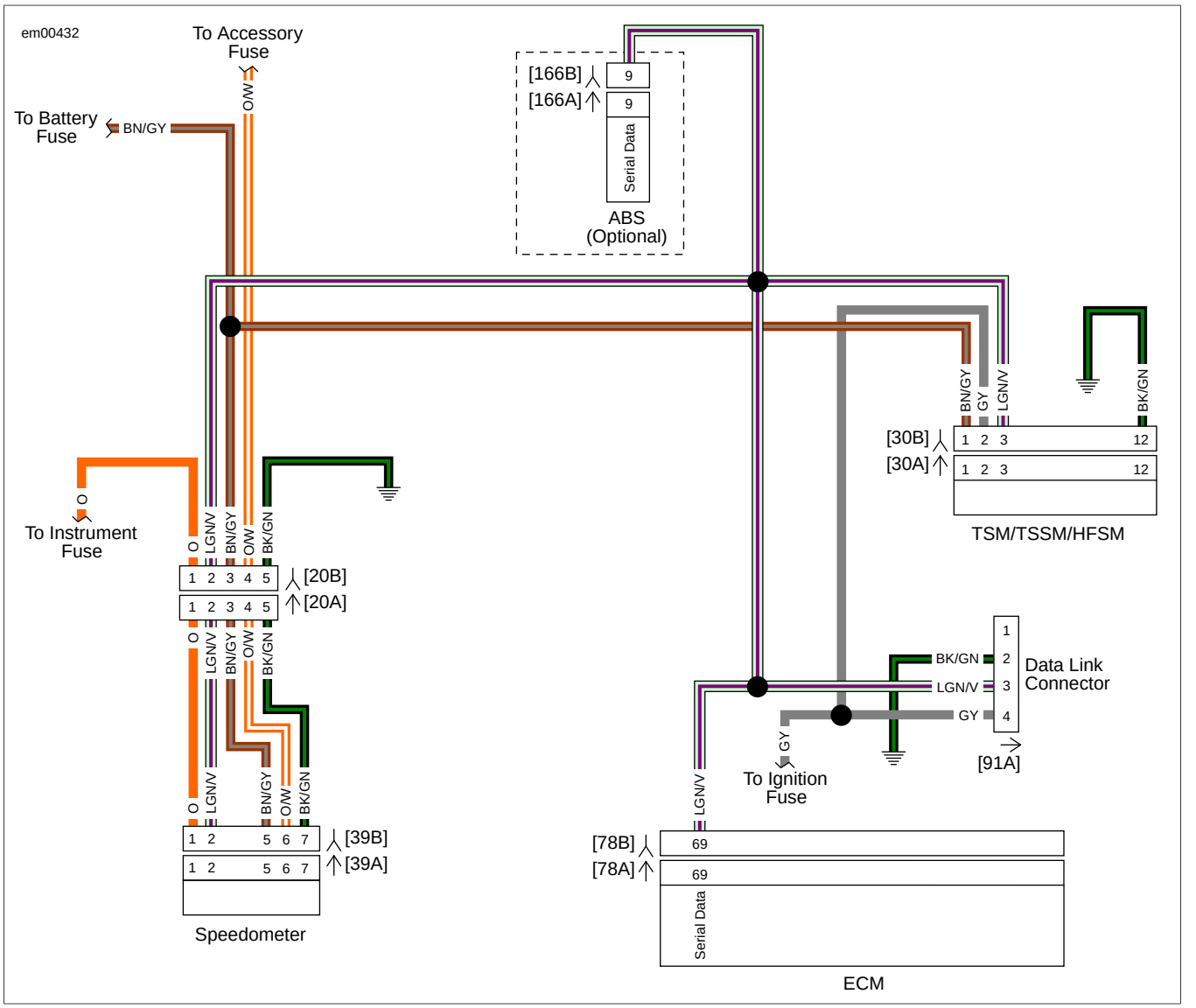
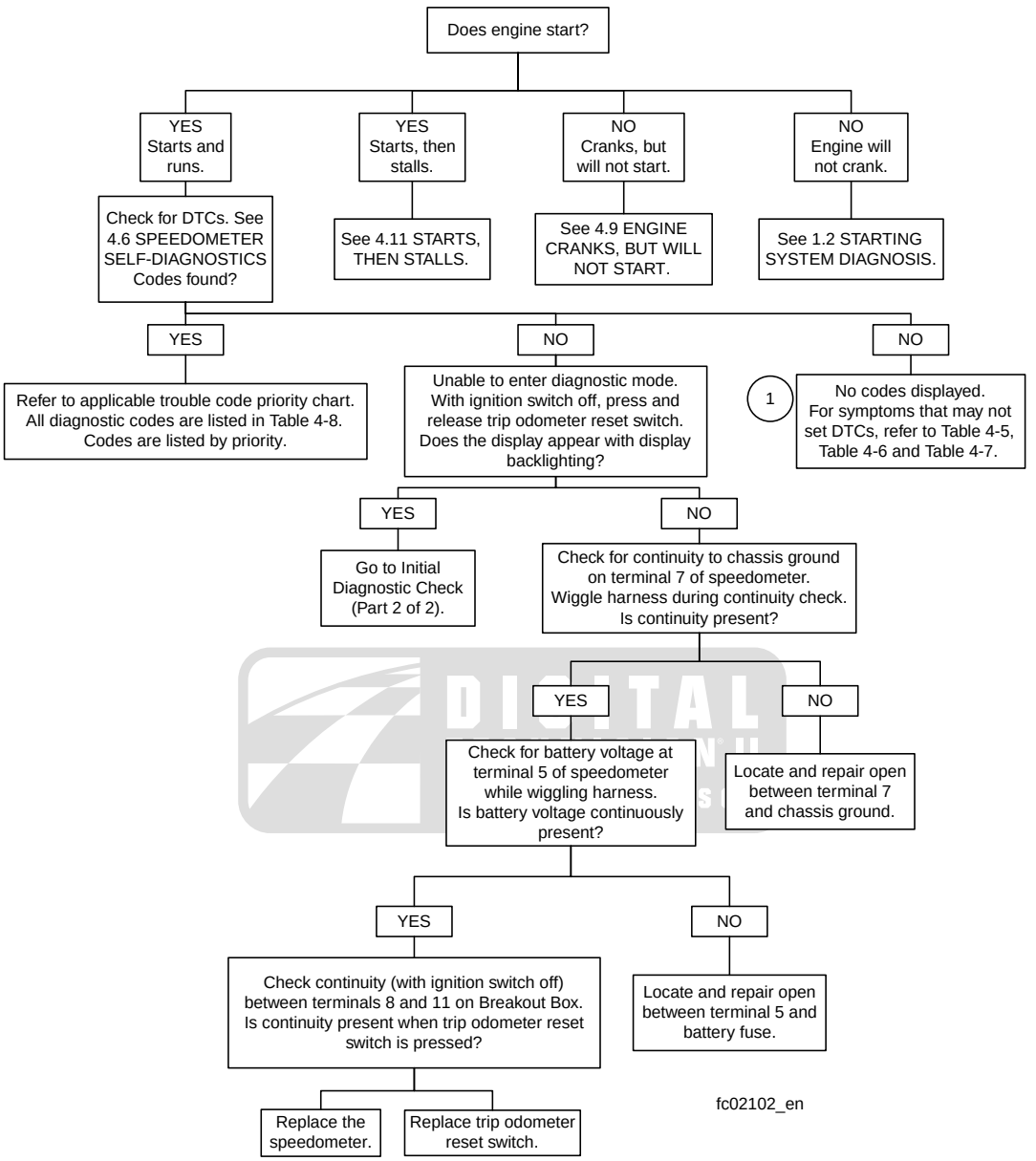


Figure 4-8. Diagnostic Check (FLHR/C)

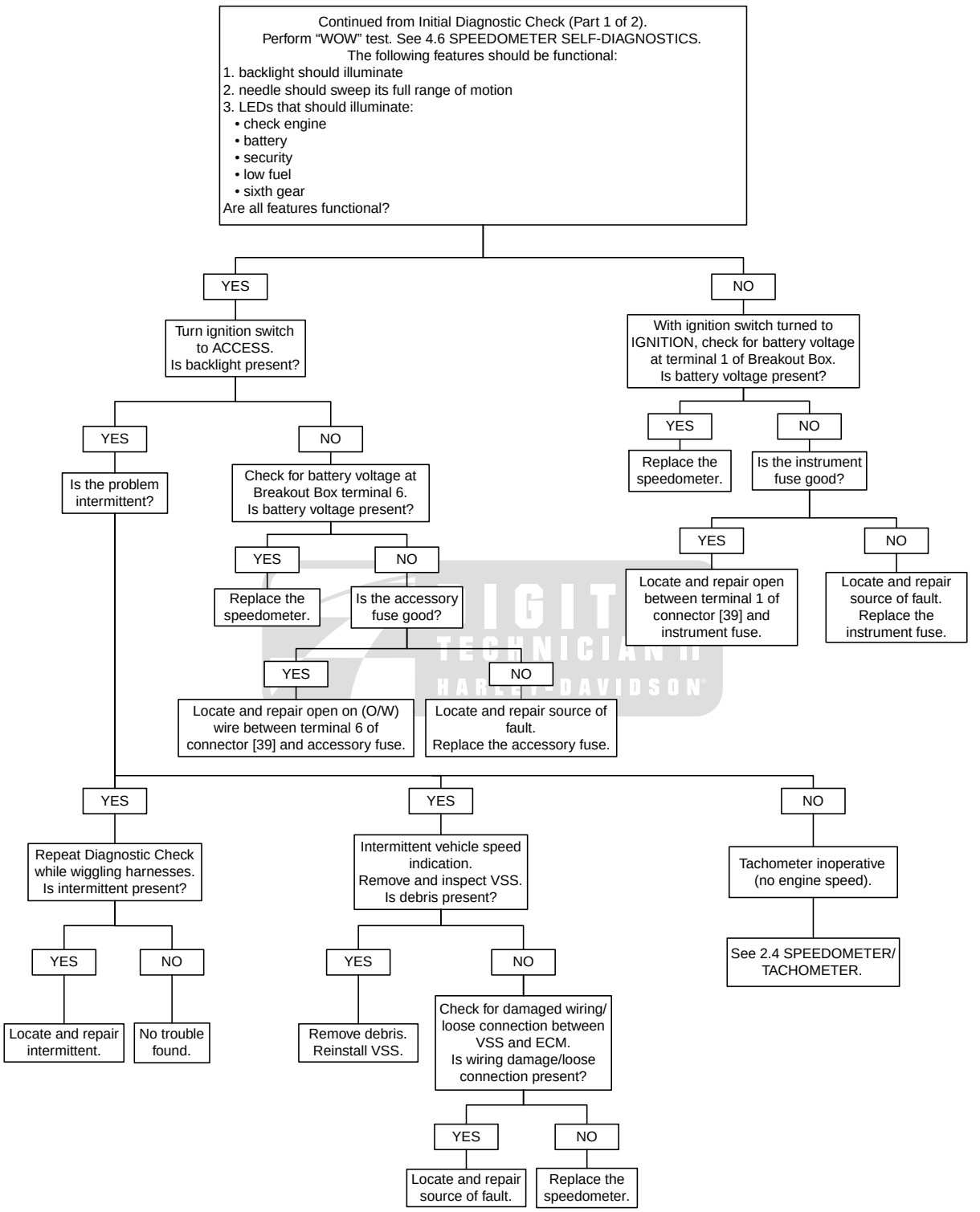
Table 4-10. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	16-place Molex	Under seat
[30]	TSM/HFSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Mini-Deutsch	Under console (back of speedometer)
[78]	ECM	73-place Delphi	Under seat
[91]	DLC	4-place Deutsch	Under left side cover
[166]	ABS module	20-place Molex	Under right side cover

Initial Diagnostic Check (Part 1 of 2)



Initial Diagnostic Check (Part 2 of 2)



SPEEDOMETER SELF-DIAGNOSTICS 4.6

GENERAL

The speedometer is capable of displaying and clearing speedometer, tachometer, TSM/TSSM/HFSM, ABS and ECM DTCs (diagnostic mode).

DIAGNOSTICS

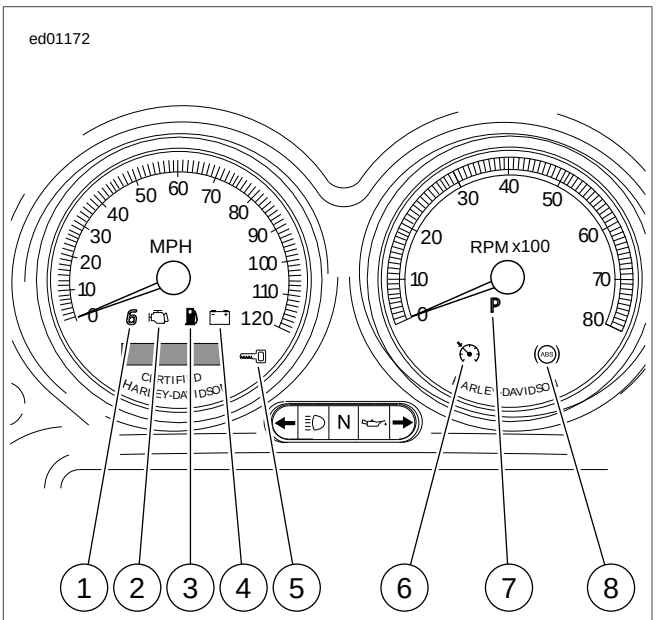
Diagnostic Tips

- See Figure 4-9. For a quick check of speedometer function, a "WOW" test can be performed. Press and hold trip odometer reset switch then turn ignition switch to IGNITION. Background lighting should illuminate, speedometer needle should sweep its full range of motion, and indicator lamps (sixth gear, check engine, low fuel, battery, security, cruise enabled, pursuit, and ABS) should illuminate. Some lamps, like the cruise enabled lamp, may illuminate even if the vehicle is not equipped with cruise control.
- If speedometer fails "WOW" test, check for battery, ground, ignition, trip odometer reset switch and accessory wiring to speedometer. If any feature in the speedometer is nonfunctional, see 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

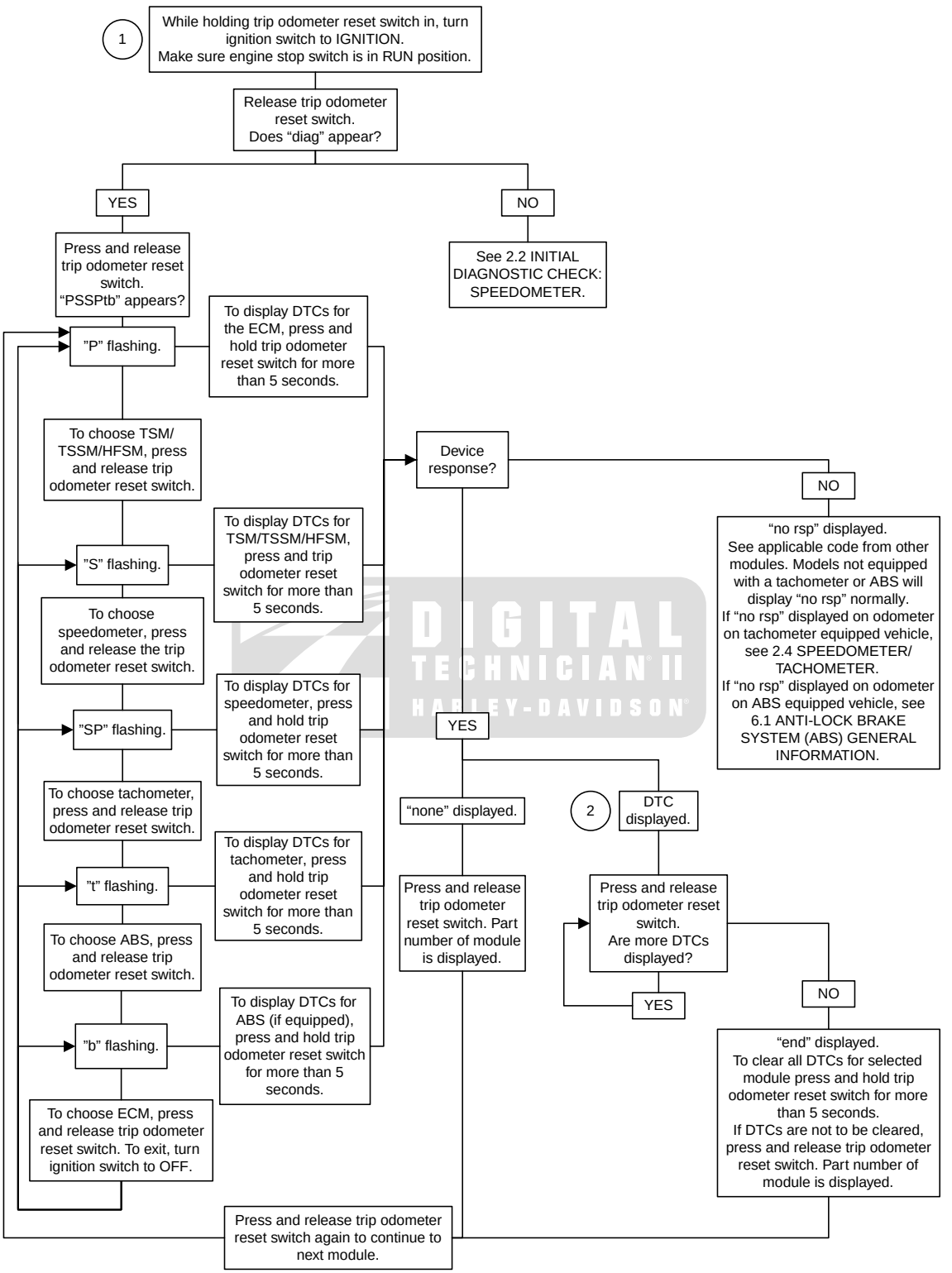
1. To exit diagnostic mode, turn ignition switch off.
2. To clear DTCs for the selected module:
 a. Press and hold the trip odometer reset switch for more than 5 seconds to display available modules, release.
 b. Press the trip odometer reset switch to choose module.
 c. Press and hold the trip odometer reset switch for more than 5 seconds to display the DTC, release.
 d. Press and hold the trip odometer reset switch for more than 5 seconds to clear DTC(s) for the module selected.



1. **Sixth gear indicator**
2. **Check engine lamp**
3. **Low fuel lamp**
4. **Battery lamp**
5. **Security lamp (key icon)**
6. **Cruise enabled lamp**
7. **Pursuit lamp**
8. **ABS lamp**

Figure 4-9. Icons (Typical)

Speedometer Self-Diagnostics



fc02165_en

BREAKOUT BOX: EFI 4.7

GENERAL

PART NUMBER	TOOL NAME
HD-48637	BREAKOUT BOX

The BREAKOUT BOX (Part No. HD-48637) splices into the main harness. Used in conjunction with a DVOM, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects.

NOTE

See wiring diagrams for ECM terminal functions.

INSTALLATION

PART NUMBER	TOOL NAME
HD-48637	BREAKOUT BOX

1. Remove the seat.
2. See Figure 4-10. Release the lock and disconnect the ECM connector [78B].
3. See Figure 4-11. Install connectors from the BREAKOUT BOX (Part No. HD-48637) to the harness connectors.

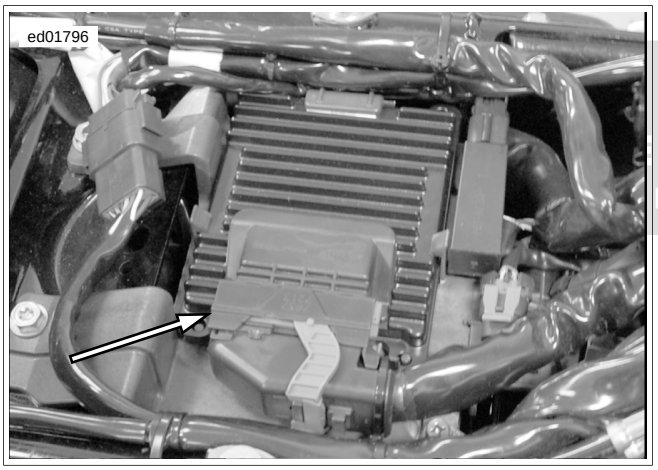


Figure 4-10. Electronic Control Module (ECM)



Figure 4-11. Breakout Box

REMOVAL

PART NUMBER	TOOL NAME
HD-48637	BREAKOUT BOX

1. Separate connectors to remove BREAKOUT BOX (Part No. HD-48637) between ECM and harness.
2. Install connector [78B] to connect harness to ECM.
3. Install the seat.

⚠WARNING

After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

WIGGLE TEST 4.8

GENERAL

The wiggle test indicates the presence of intermittents in a wiring harness.

PROCEDURE

PART NUMBER	TOOL NAME
HD-39978	DVOM
HD-48637	BREAKOUT BOX

1. See Figure 4-12. Connect DVOM (Part No. HD-39978) to wiring harness between the suspect connections. When diagnosing ECM connections, use a BREAKOUT BOX (Part No. HD-48637) to simplify the procedure. See 4.7 BREAKOUT BOX: EFI.
2. Set DVOM to read voltage changes.
3. Start motorcycle engine and run at idle.
4. Shake or wiggle harness to detect intermittents. If intermittents are present, radical voltage changes will register on the DVOM.

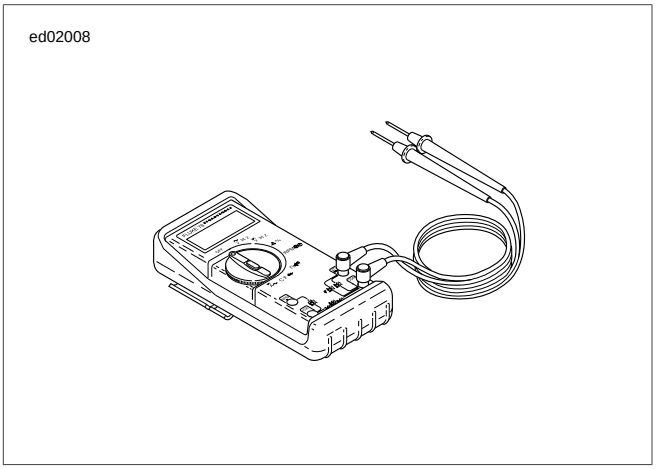


Figure 4-12. Fluke 78 Multimeter (DVOM) (Part No. HD-39978)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

ENGINE CRANKS, BUT WILL NOT START 4.9

GENERAL

If the starter will not crank the engine, the problem is not EFI related. See the following chapters:

- CHAPTER 1 - STARTING / CHARGING.
- CHAPTER 3 - TSM/HFSM.
- Appendix E - TSM/TSSM (Japan/Korea).

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-26792	SPARK TESTER
HD-34730-2C	FUEL INJECTOR TEST LAMP
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-44687	IGNITION COIL CIRCUIT TEST ADAPTER
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Check for DTCs. See 4.4 CHECKING FOR DIAGNOSTIC TROUBLE CODES: EFI, Retrieving Diagnostic Trouble Codes.
2. Check the condition of the battery. Perform a voltage test and recharge if below 12.6V. Check battery connections and perform load test. Replace the battery if necessary. See Battery in the service manual.
3. Connect BREAKOUT BOX (Part No. HD-48637). See 4.7 BREAKOUT BOX: EFI.
4. Remove spark plug cable from spark plug.
 a. Visually check condition of plug.
 b. See Figure 4-13. Attach cable to SPARK TESTER (Part No. HD-26792). Clip tester to cylinder head bolt.
 c. While cranking engine, look for spark. Repeat procedure on other spark plug cables.

NOTE

Engine will not spark with both spark plugs removed. When checking for spark, use SPARK TESTER (Part No. HD-26792) with both plugs installed.

5. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord.
6. Plug IGNITION COIL CIRCUIT TEST ADAPTER (Part No. HD-44687) and FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C) into Breakout Box terminals 72 and 53. Start engine. If lamp flashes, no problem is found. Repeat for Breakout Box terminals 72 and 54.
7. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown socket probe and patch cord.

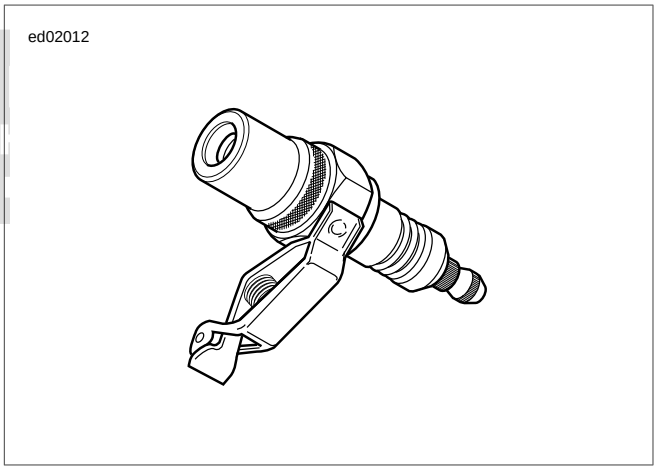


Figure 4-13. Spark Tester

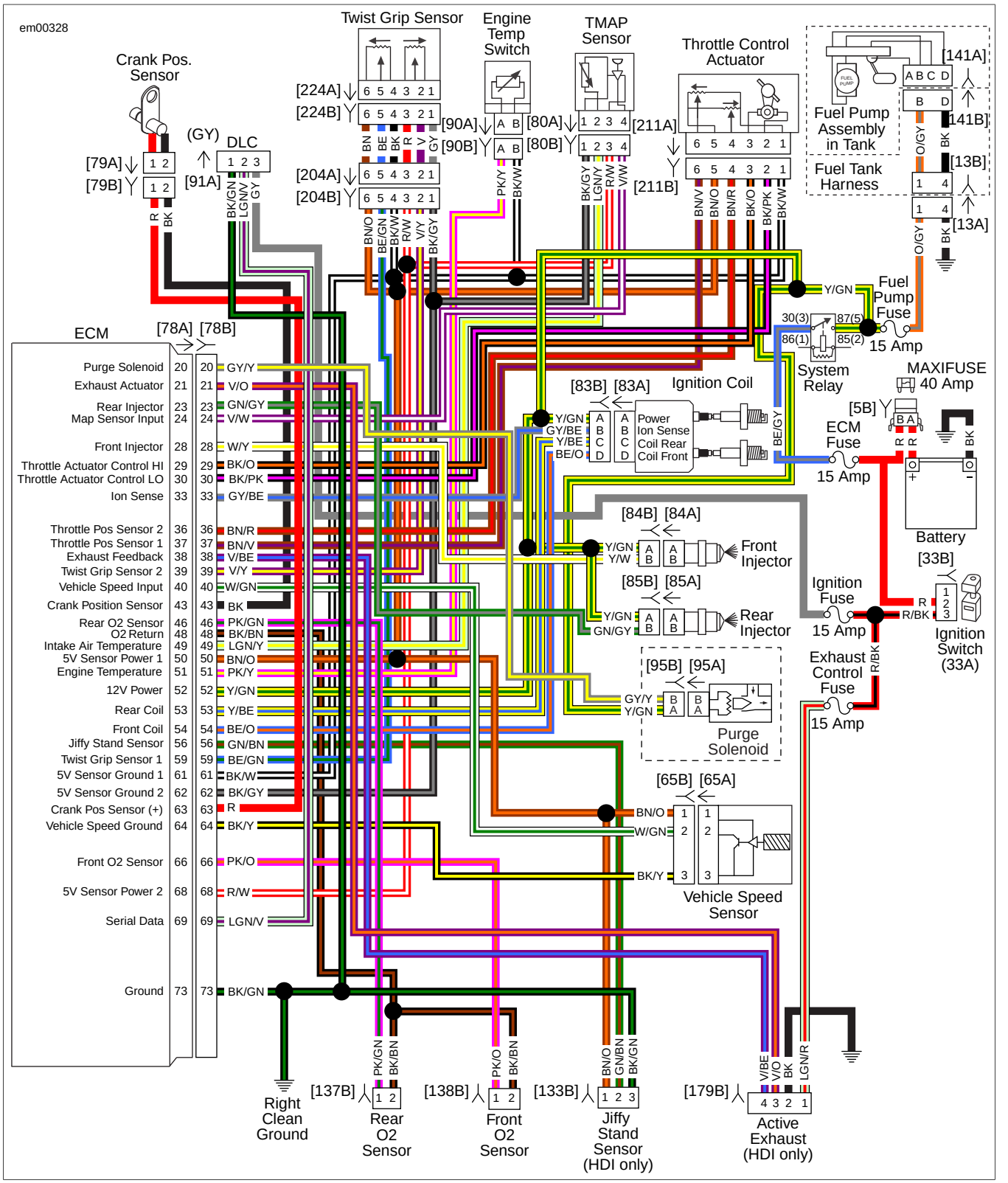


Figure 4-14. EFI Circuit (FLHX, FLHT/C/U, FLTR)

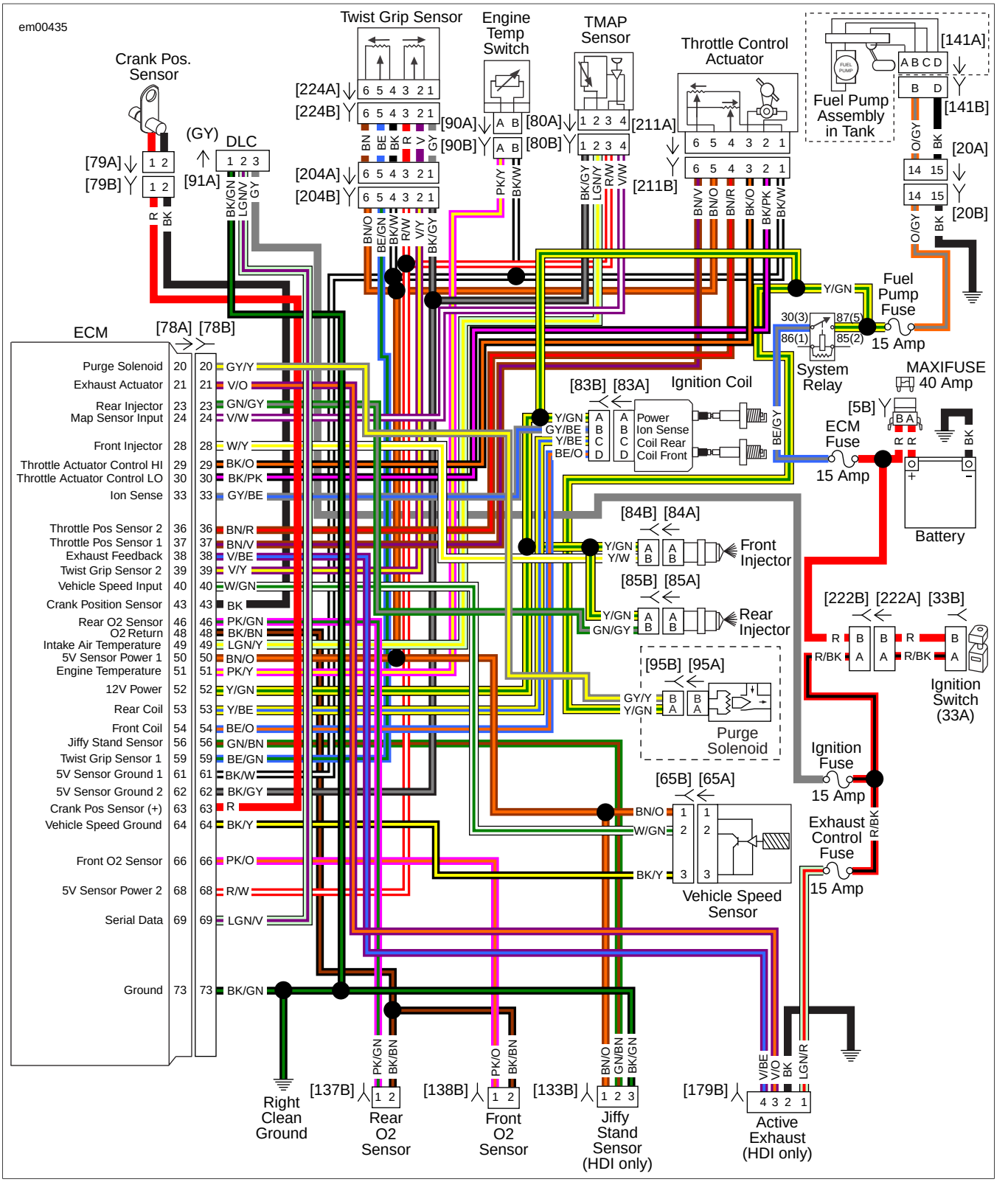


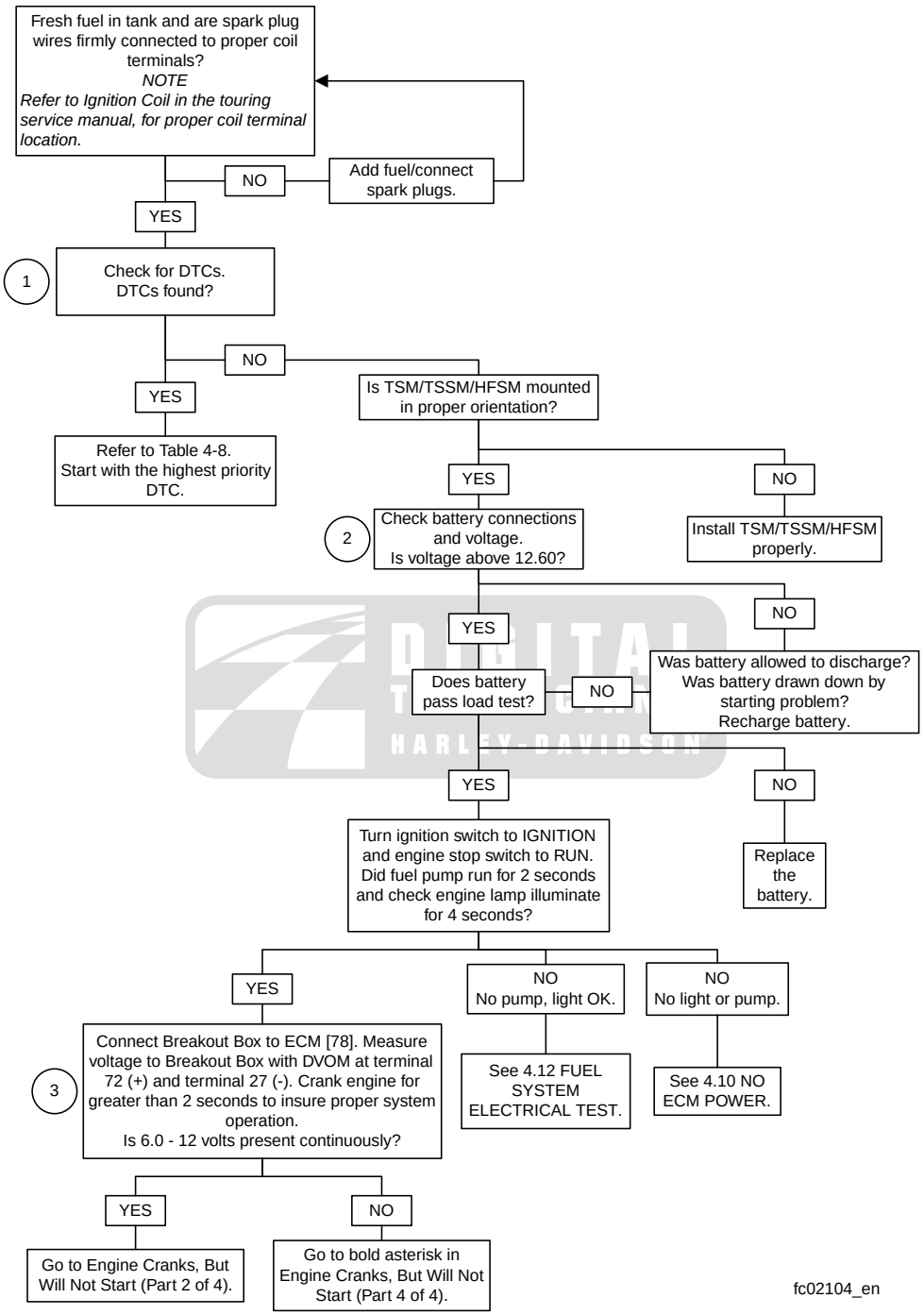
Figure 4-15. EFI Circuit (FLHR/C)

Table 4-11. Wire Harness Connectors

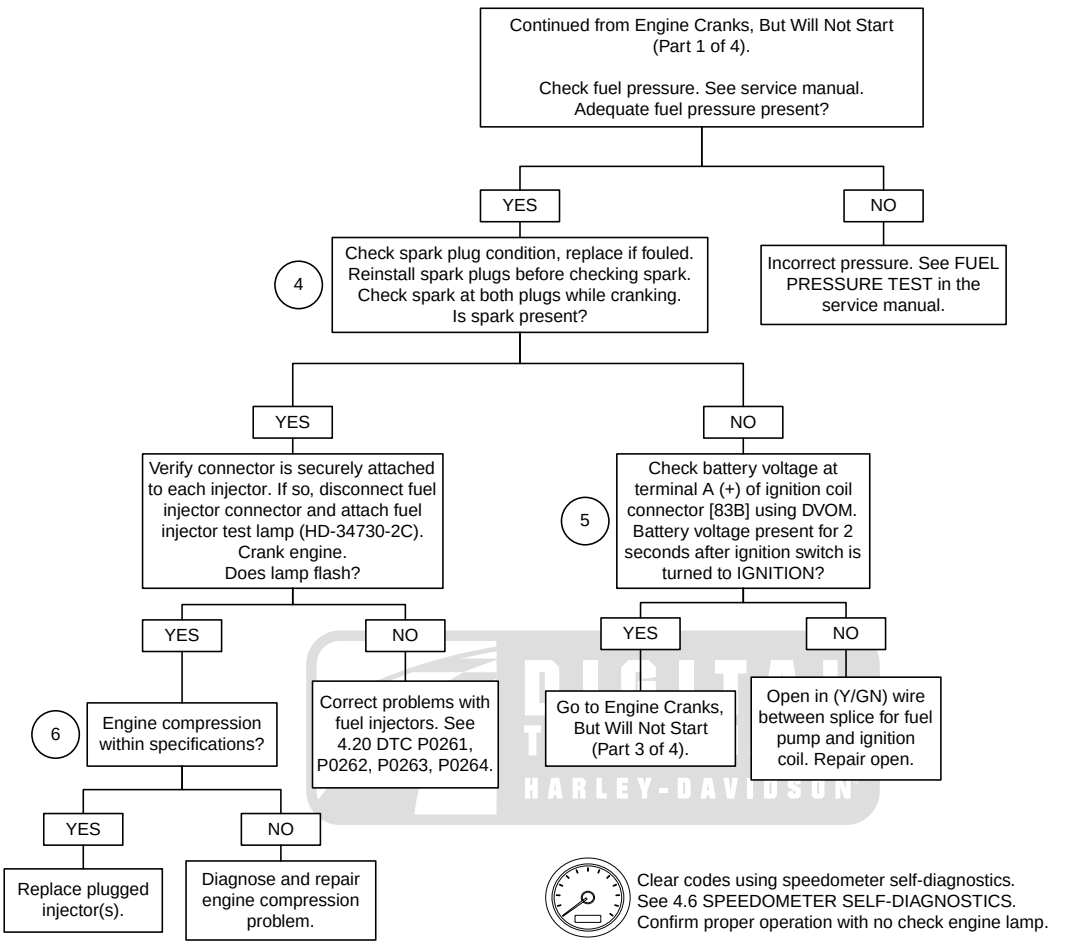
NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[13]	Fuel tank harness	All	4-place Multilock	Behind fuel tank (under seat)
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[33]	Ignition switch	FLHT/C/U/ FLTR	3-place Packard	Bottom of ignition switch housing
		FLHR/C	3-place Packard	Under console
[65]	VSS	All	3-place Delphi	Top of transmission case (under starter)
[78]	ECM	All	73-place Delphi	Under seat
[79]	CKP sensor	All	2-place Mini-Deutsch	Rear of lower front frame crossmember
[80]	TMAP sensor	All	4-place Delphi	Top of induction module
[83]	Ignition coil	All	4-place Delphi	Bottom front of battery tray
[84]	Front injector	All	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	All	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	All	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	All	4-place Deutsch	Under left side cover
[95]	Purge solenoid	All	2-place Delphi	Under seat
[133]	Jiffy stand sensor	All	3-place Molex (black)	Domestic (not used): Rear of lower front frame crossmember HDI: Rear of lower front frame cross-member
[137]	O2 sensor rear exhaust header	All	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	All	2-place Amp (Tyco)	Back of cross brace front frame downtubes
[141]	Fuel pump and fuel level sender	All	4-place Packard	Under console, on top of fuel tank canopy
[179]	Active exhaust actuator	All	5-place Amp (Tyco)	Domestic (not used): Under right side cover HDI: Under right side cover
[204]	TGS harness	FLTR	6-place Molex	Inner fairing right side below radio
		FLHT/C/U	6-place Molex	Inner right fairing support bracket
[211]	TCA	All	6-place Molex	Right side of engine (induction module)
[222]	Console ignition switch interconnect	FLHR/C	4-place Packard	Under seat
[224]	TGS	All	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)

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Engine Cranks, But Will Not Start (Part 1 of 4)

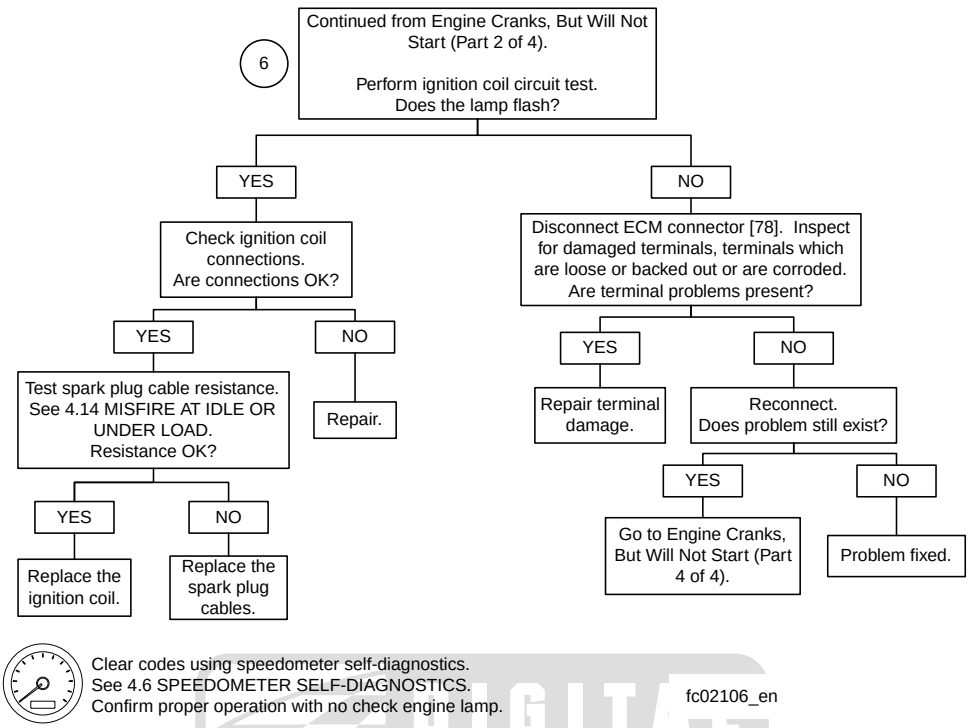


Engine Cranks, But Will Not Start (Part 2 of 4)



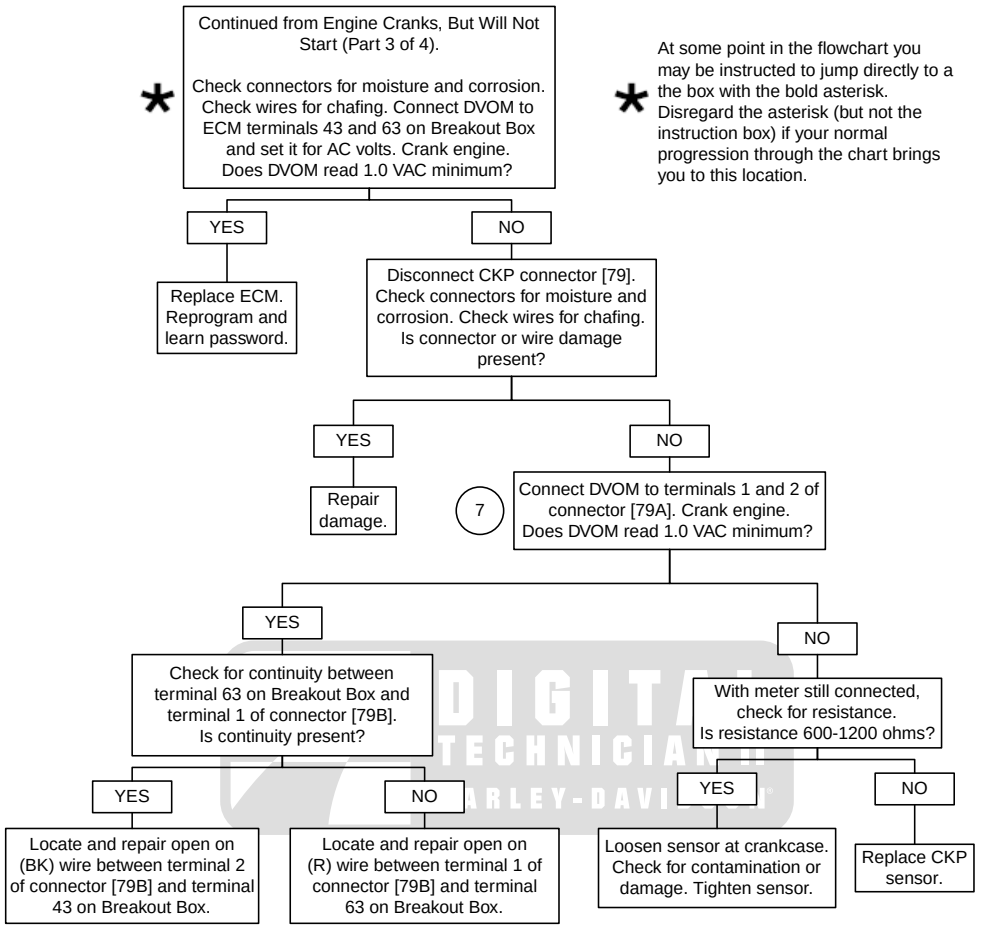
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Engine Cranks, But Will Not Start (Part 3 of 4)



DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Engine Cranks, But Will Not Start (Part 4 of 4)



* At some point in the flowchart you may be instructed to jump directly to a the box with the bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

NO ECM POWER 4.10

GENERAL

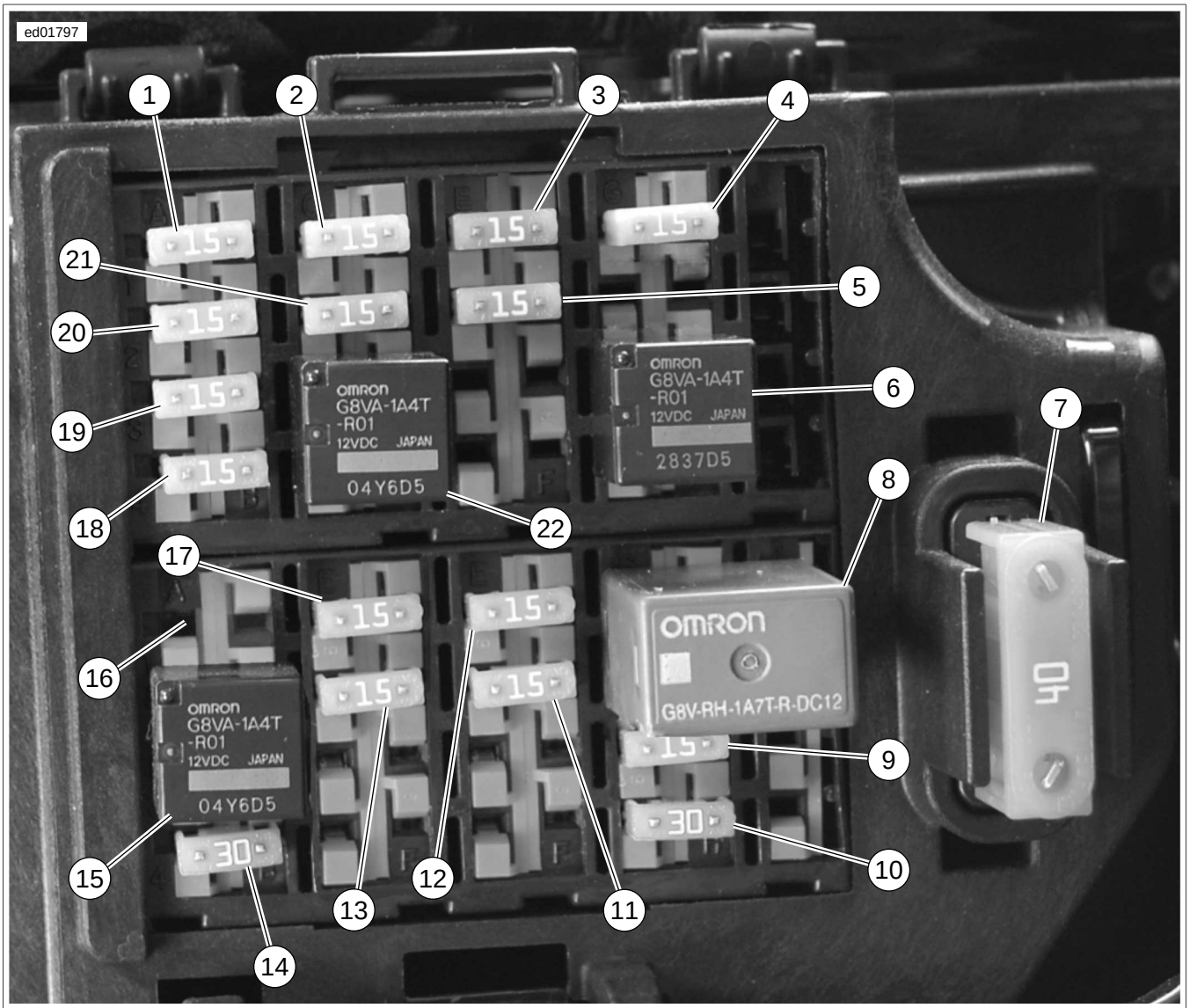
No Spark/No Check Engine Lamp at IGNITION

Constant power is supplied to the ECM through terminal 71. The ECM turns on when power is applied to terminal 72 of connector [78]. The ECM goes through an initialization sequence every time power is removed and re-applied to terminal 72. The only visible part of this sequence is the check engine lamp. Upon starting, the check engine lamp will illuminate for 4 seconds and then (if parameters are normal) go out. See Figure 4-16, Figure 4-17, and Figure 4-18.

If battery power is absent at ECM terminal 71:

- DTCs cannot be cleared. Tool will show them as cleared but will be present next time ignition key is cycled.
- ECM cannot be re-flashed.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®



1. Brake/cruise
2. Accessory
3. P&A
4. Radio power/Siren
5. ECM power
6. Start relay
7. MAXIFUSE
8. Lighting relay
9. Spare
10. Spare
11. Lights
12. Ignition
13. Headlamp
14. ABS
15. Brake relay
16. P&A IGN (2A Max)
17. Instruments
18. Fuel pump
19. Exhaust control
20. Radio memory
21. Battery
22. System relay

Figure 4-16. Fuse and Relay Locations

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637). See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B); purple probes and patch cords.

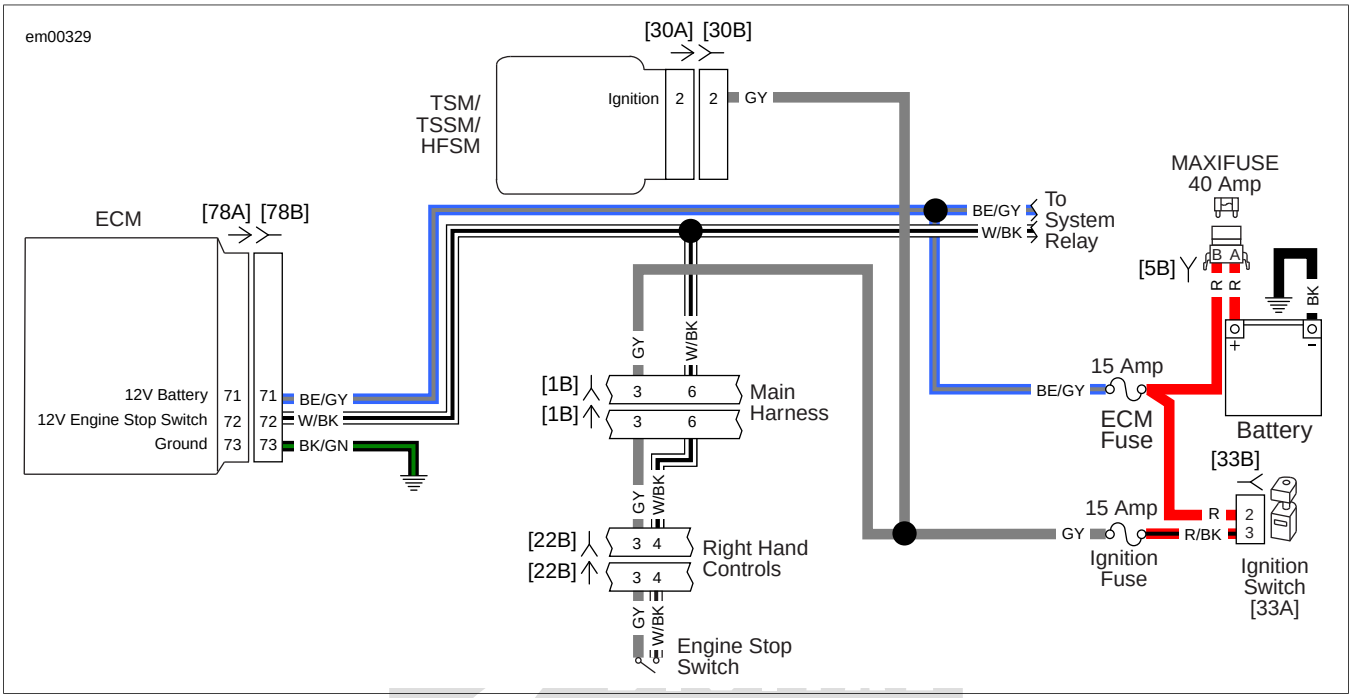


Figure 4-17. ECM Power Circuit (FLHX, FLHT/C/U, FLTR)

Table 4-12. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C/U/X	16-place Molex (Black)	Inner fairing (right radio support bracket)
		FLTR	16-place Molex (Black)	Inner fairing right side below radio
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[22]	Right handlebar switches	FLTR	12-place Molex (Black)	Inner fairing on left radio bracket
		FLHT/C/U/X	12-place Molex (Black)	Inner fairing right fairing support bracket
[30]	TSM/TSSM/HFSM	All	12-place Deutsch	Under right side cover
[33]	Ignition switch	All	3-place Packard	Bottom of ignition switch housing
[78]	ECM	All	73-place Delphi	Under seat

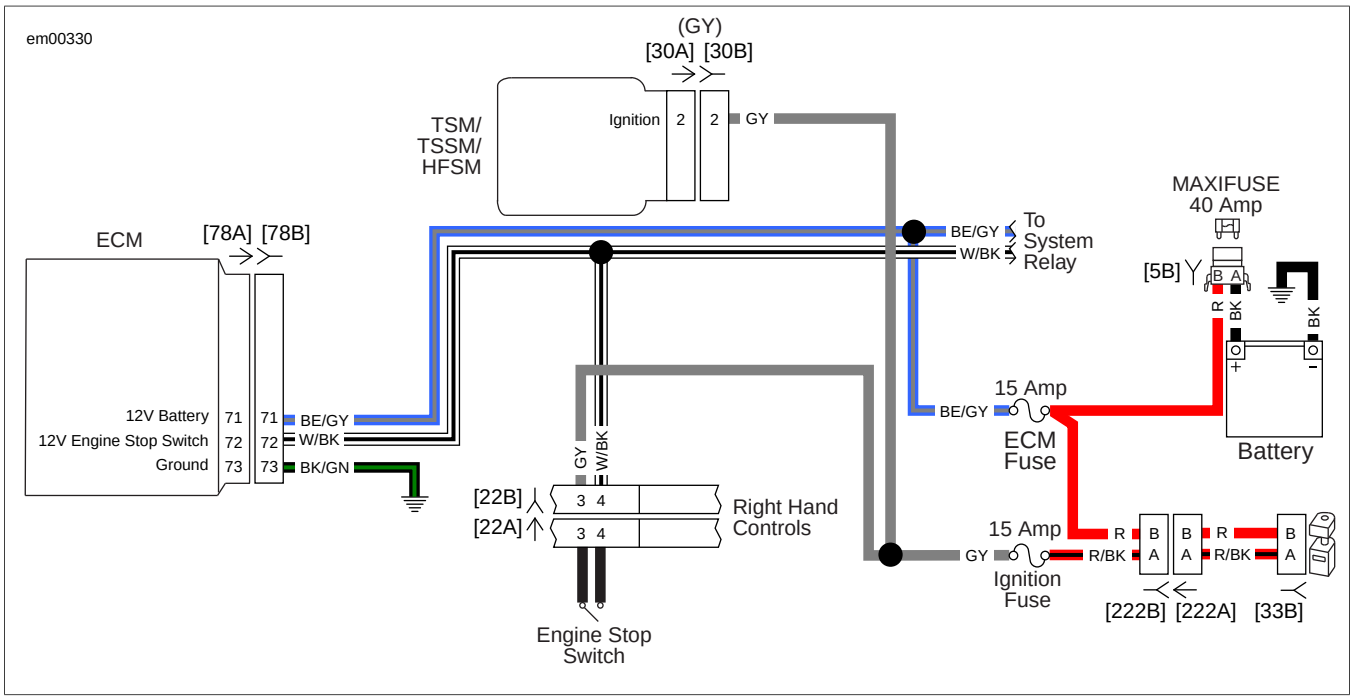


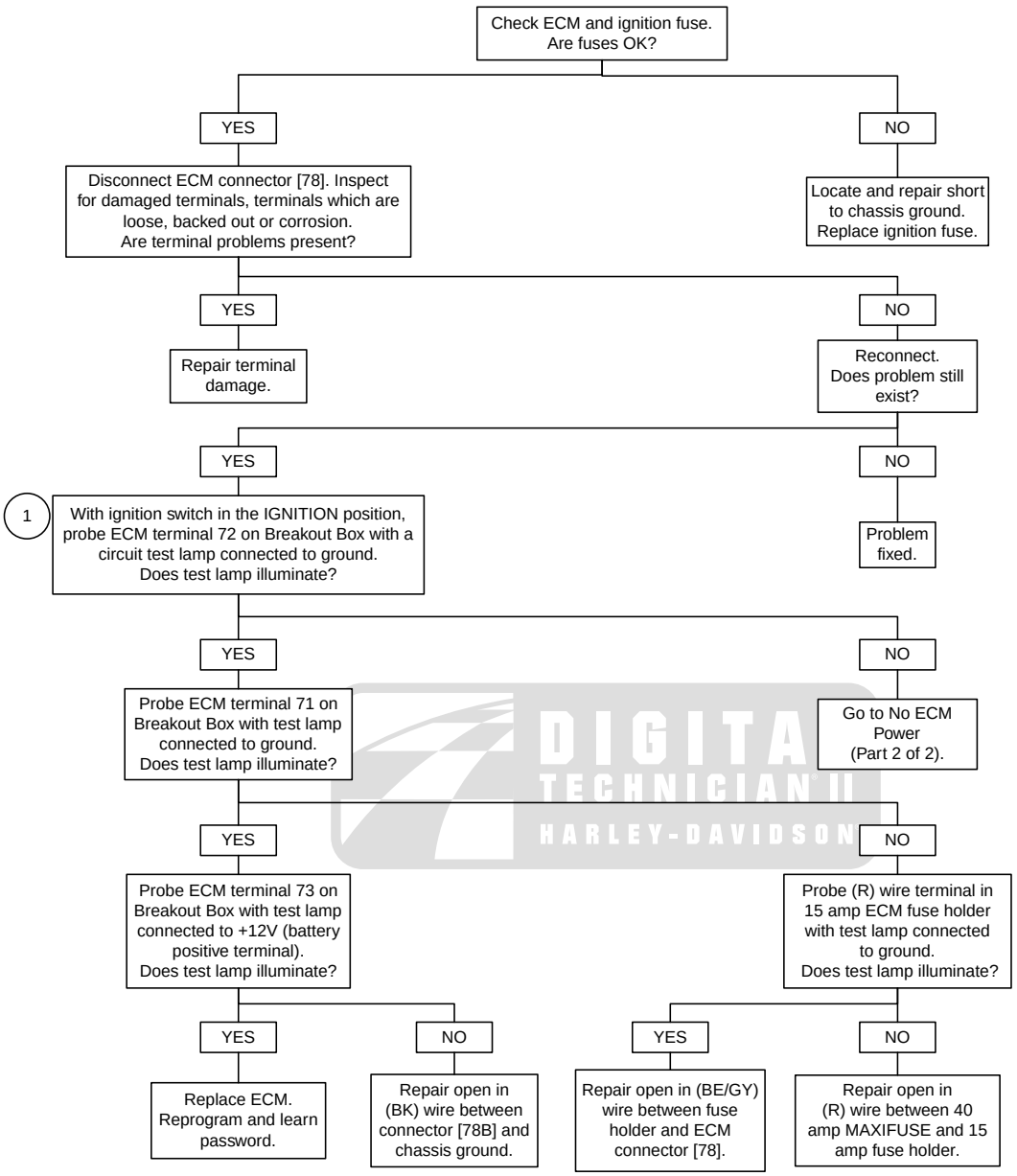
Figure 4-18. ECM Power Circuit (FLHR/C)

Table 4-13. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Right handlebar switches	6-place Molex (Black)	Inside headlamp nacelle - fork stern nut lock plate (right side)
[33]	Ignition switch	3-place Packard	Under console
[78]	ECM	73-place Delphi	Under seat
[222]	Console ignition switch interconnect	4-place Packard	Under seat

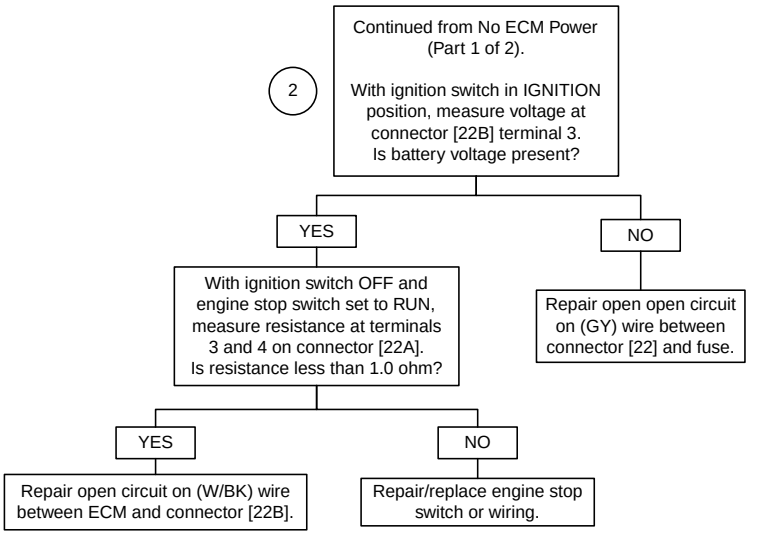
TECHNICIAN II HARLEY-DAVIDSON

No ECM Power (Part 1 of 2)



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No ECM Power (Part 2 of 2)





Clear codes using speedometer self-diagnostics.
See 4.6 SPEEDOMETER SELF-DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

fc02109_en

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

STARTS, THEN STALLS 4.11

GENERAL

Diagnostic Trouble Codes U1300, U1301, or BUS ER

The typical serial data voltage range is 0 volt (inactive) to 7 volts (active). Due to the short pulse, voltages will be much lower on a DVOM. In analog mode, a DVOM reading serial data will show continuous voltage when active, typically 0.6-0.8 volt. The range for acceptable operations is greater than 0 and less than 7.0 volts.

NOTE

Problems in the fuel system may also create this symptom.

Table 4-14. Code Description

DTC	DESCRIPTION
U1300	Serial data low
U1301	Serial data open/high



Figure 4-19. ECM DLC

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT

Diagnostic Tips

- If serial data is shorted, these codes automatically trip the check engine light.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.
- If the vehicle is equipped with the advanced audio system and the radio ground and antenna ground are open, a serial data BUS fault may occur causing a start and stall condition.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), black socket probes and patch cord.
2. Unplug the neutral switch connector [131]. Using a DVOM, test for continuity between terminals A and B of the neutral switch.
 a. When the transmission is in NEUTRAL, continuity should exist.
 b. When the transmission is in gear, there should be no continuity through the neutral switch.

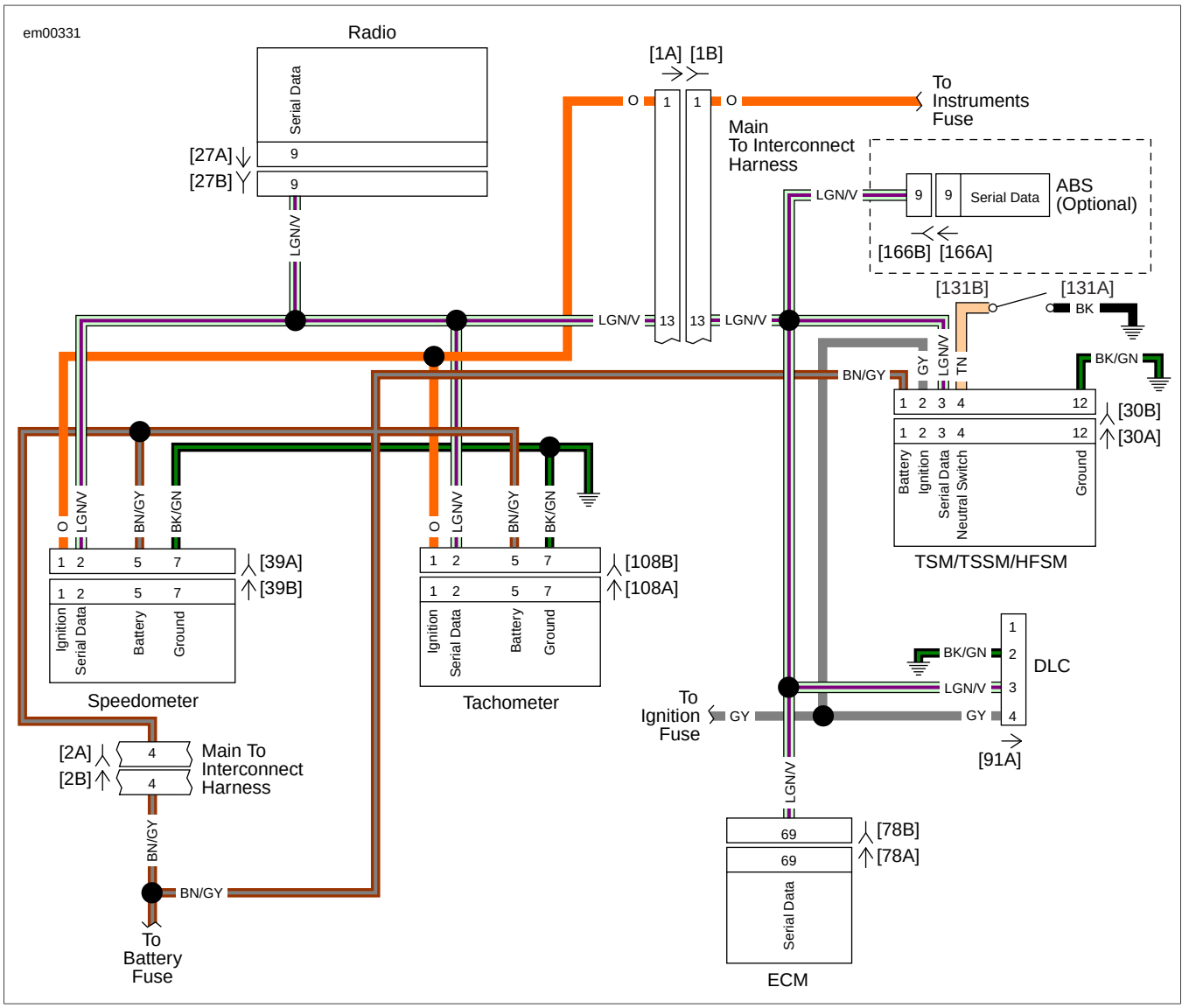


Figure 4-20. Serial Data Circuit (FLHX, FLHT/C/U, FLTR)

Table 4-15. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (black)	Inner fairing - (right radio support bracket)
		FLTR	16-place Molex (black)	Inner fairing - (right side below radio)
[2]	Main to interconnect harness	FLHT/C	12-place Molex (gray)	Inner fairing - (right fairing support bracket)
		FLTR	12-place Molex (gray)	Inner fairing -(left radio support bracket)
[27]	Radio	All	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[30]	TSM/TSSM/HFSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHT/C	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Under bezel (back of speedometer)
[78]	ECM	All	73-place Delphi	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover
[108]	Tachometer	FLHT/C	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)

Table 4-15. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[131]	Neutral switch	All	Post terminal	Top of transmission (right side)
[166]	ABS module	All	20-place Molex	Under right side cover

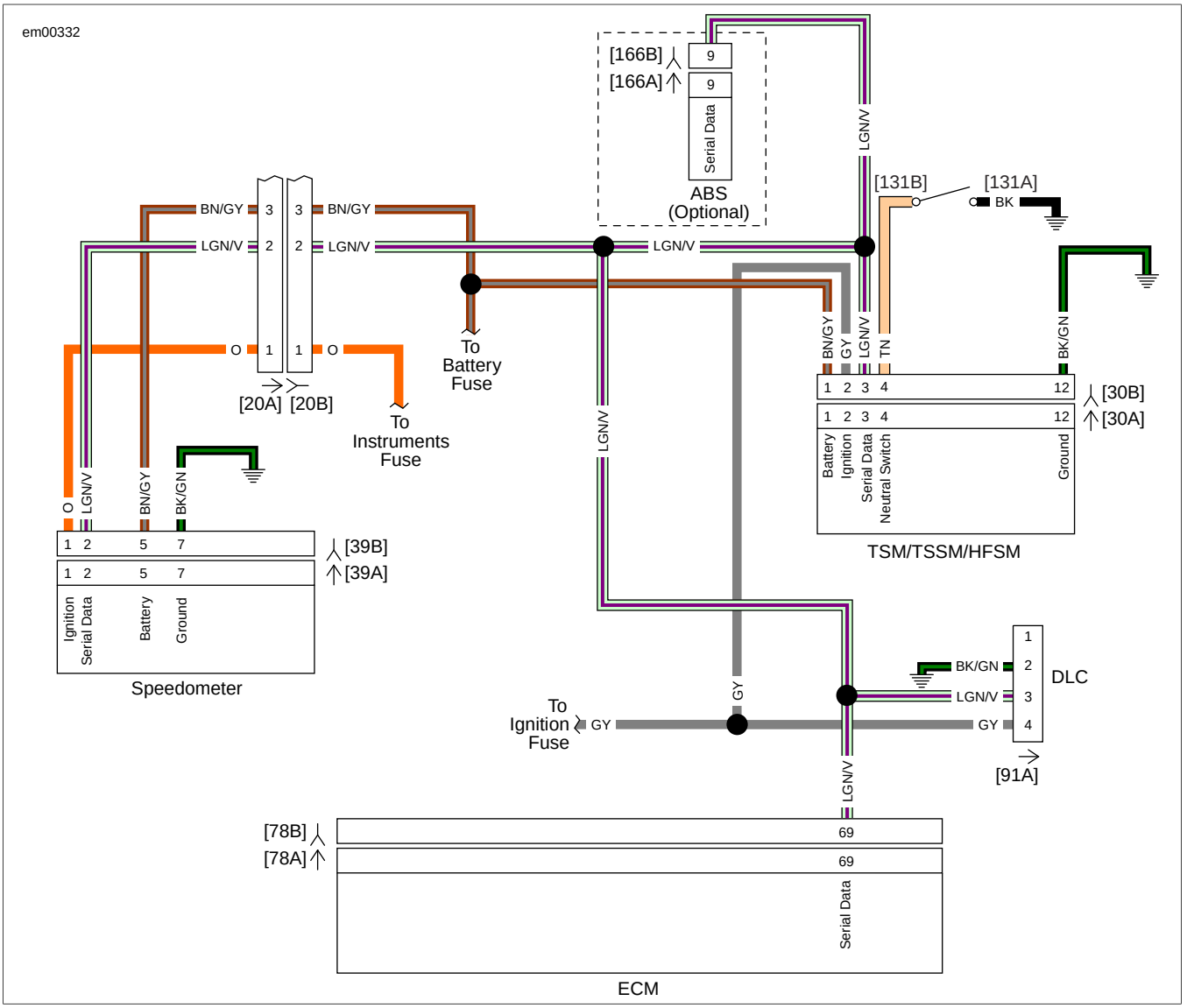


Figure 4-21. Serial Data Circuit (FLHR/C)

Table 4-16. Wire Harness Connectors

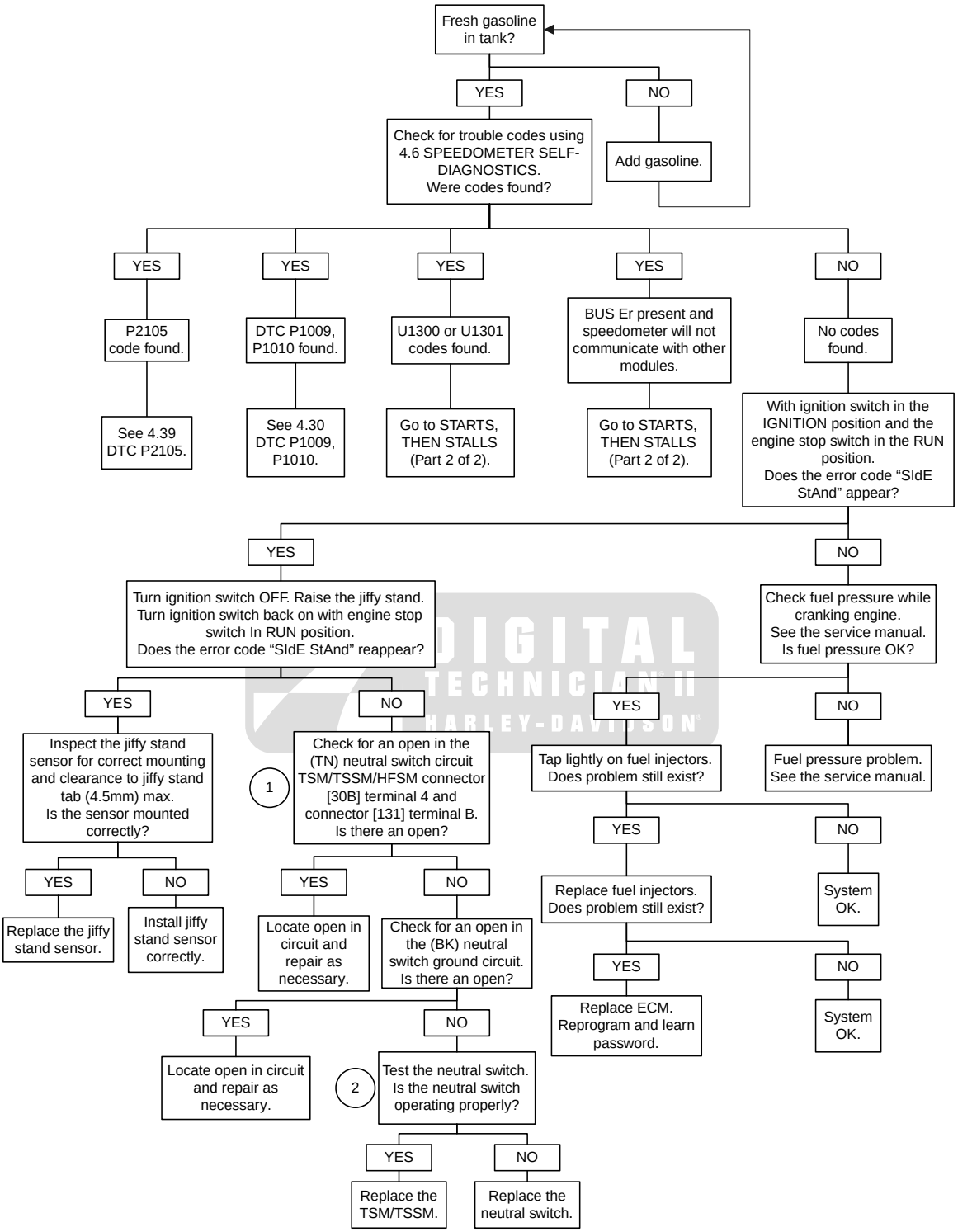
NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	16-place Molex	Under seat
[30]	TSM/TSSM/HFSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Packard	Under console (back of speedometer)
[78]	ECM	73-place Delphi	Under seat

Table 4-16. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[91]	DLC	4-place Deutsch	Under left side cover
[131]	Neutral switch	Post terminal	Top of transmission (right side)
[166]	ABS module	20-place Molex	Under right side cover

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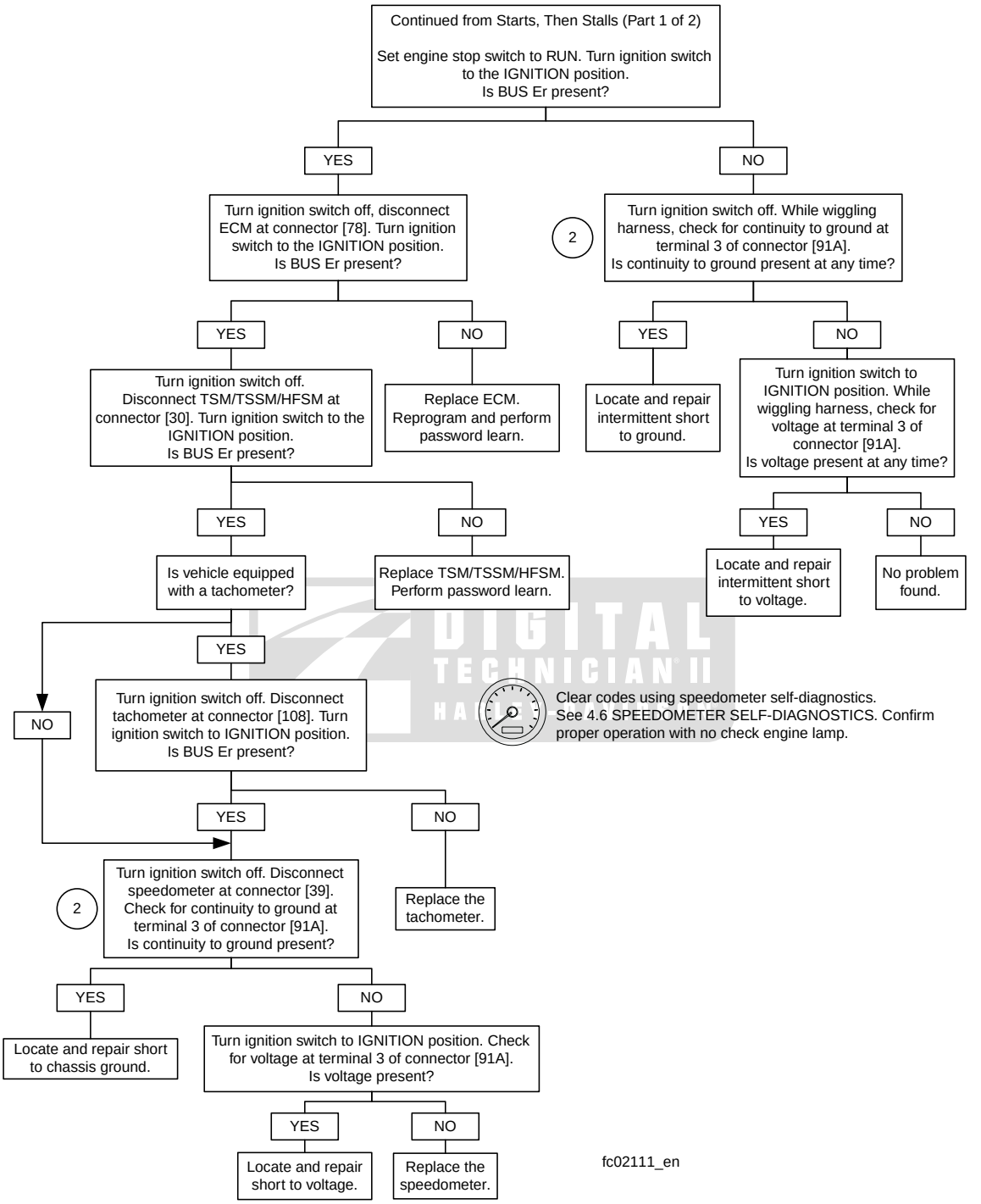
Starts, Then Stalls (Part 1 of 2)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

fc02110_en

Starts, Then Stalls (Part 2 of 2)



FUEL SYSTEM ELECTRICAL TEST 4.12

GENERAL

With the ignition switch to IGNITION and the engine stop switch at RUN, the ECM energizes the system relay to complete the circuit to the in-tank fuel pump. It remains on as long as the engine is cranking or running, and the ECM is receiving ignition reference pulses from the CKP sensor. If there are no reference pulses, the ECM de-energizes the system relay within 2 seconds after ignition is on or engine has stalled, or immediately after the ignition is shut off.

The fuel pump delivers fuel to the injectors. The pressure regulator is where the system pressure is controlled. Excess fuel flow is bypassed into the fuel tank through the pressure regulator. When the engine is stopped, the pump can be turned on by applying battery voltage and ground to the fuel pump connector [141A].

See Figure 4-22. The fuel pump connector is located rearward of the fuel tank under the seat. Improper fuel system pressure may contribute to one or all of the following symptoms.

- Engine cranks, but will not run.
- Engine cuts out (may feel like ignition problems).
- Hesitation, loss of power and poor fuel economy.

NOTE

After turning the ignition off, wait 10 seconds before turning the ignition back on to get the fuel pump to reprime. This time out period is necessary for the ECM to reset.

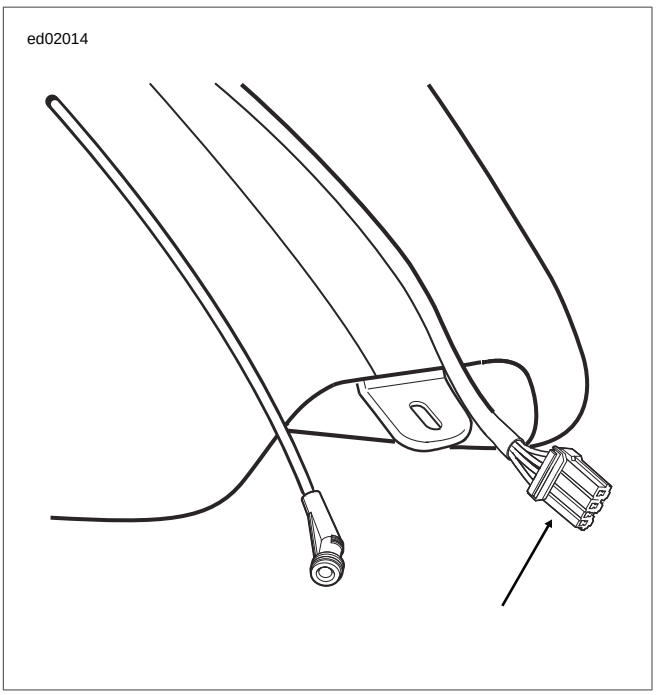


Figure 4-22. Fuel Pump/Fuel Level Sender Connector (FLHX, FLHT/C/U, FLTR)

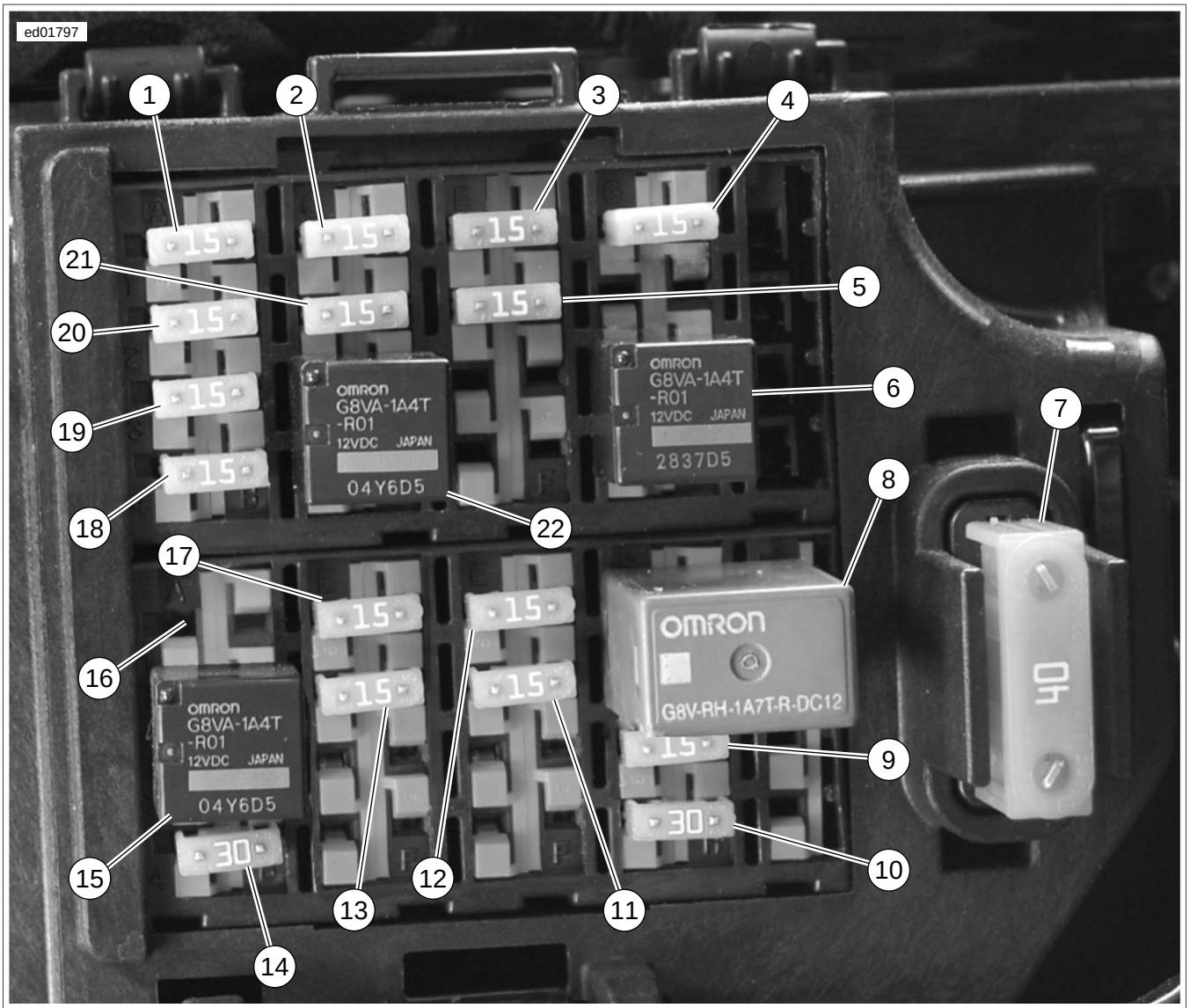
DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Turns on fuel pump if wiring is OK. If pump runs, problem is in basic fuel delivery.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray probe and patch cord.
3. Connect BREAKOUT BOX (Part No. HD-48637). See 4.7 BREAKOUT BOX: EFI.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord.



1. Brake/cruise
2. Accessory
3. P&A
4. Radio power/Siren
5. ECM power
6. Start relay
7. MAXIFUSE
8. Lighting relay
9. Spare
10. Spare
11. Lights
12. Ignition
13. Headlamp
14. ABS
15. Brake relay
16. P&A IGN (2A Max)
17. Instruments
18. Fuel pump
19. Exhaust control
20. Radio memory
21. Battery
22. System relay

Figure 4-23. Fuse and Relay Locations

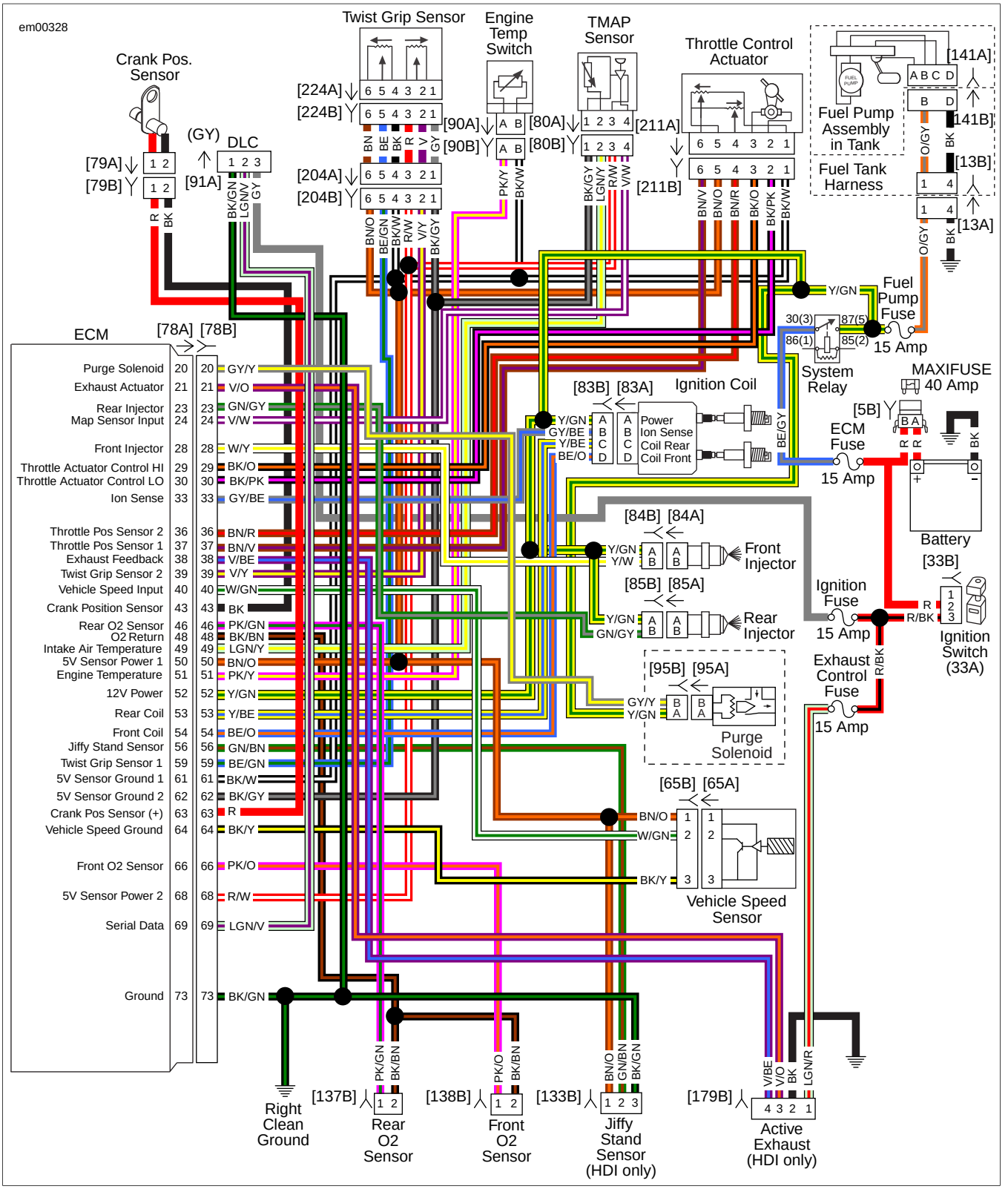


Figure 4-24. EFI Circuit (FLHX, FLHT/C/U, FLTR)

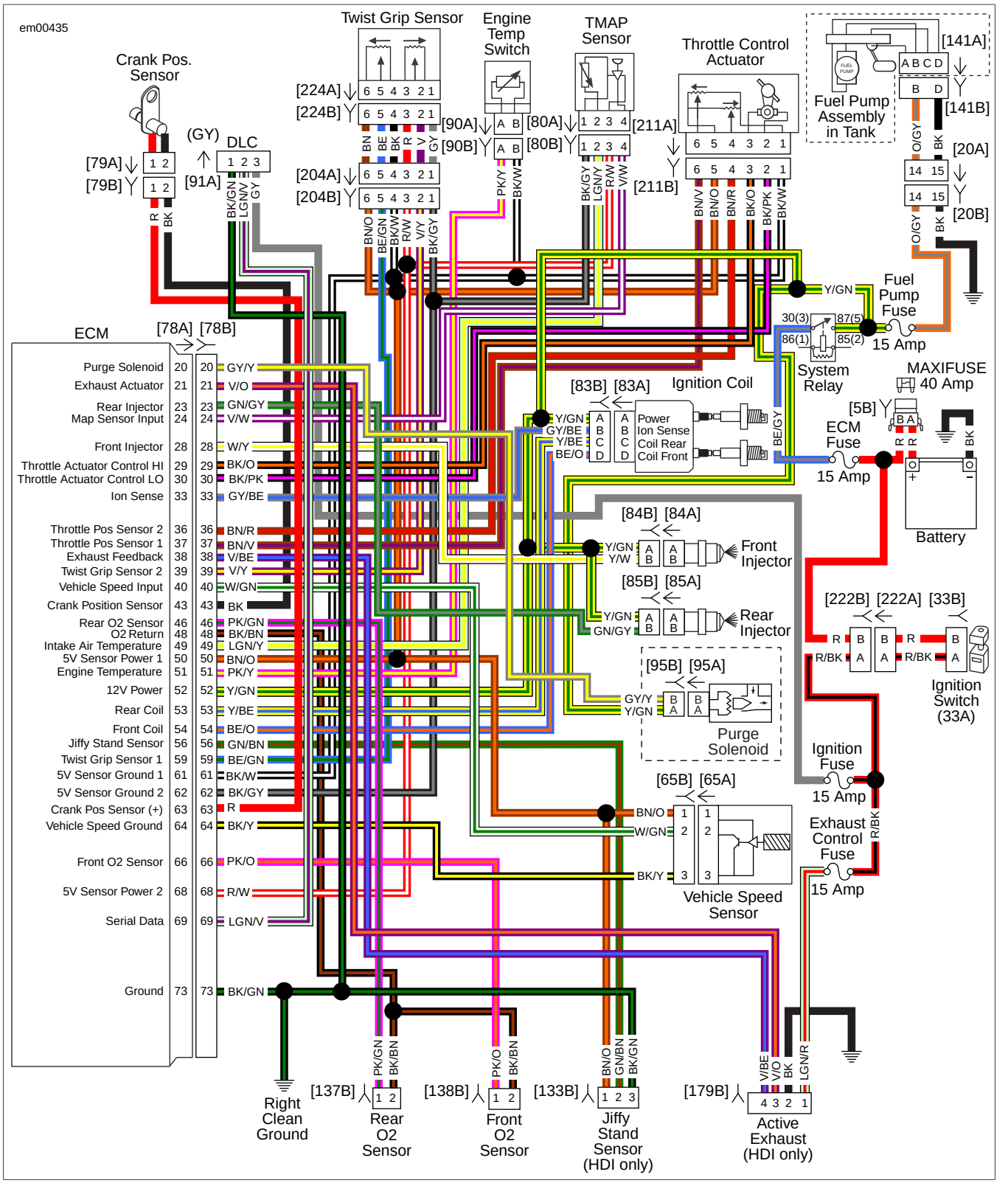


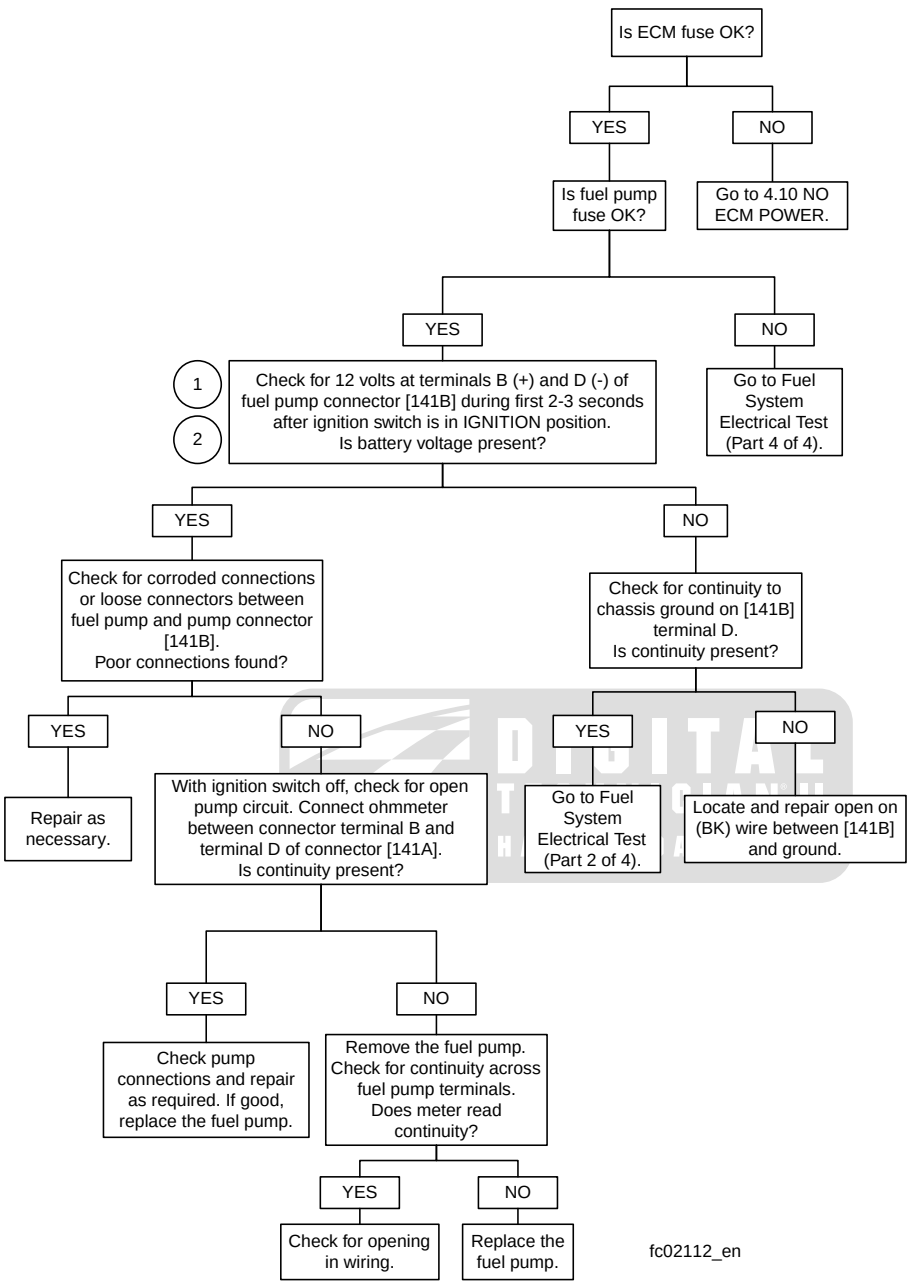
Figure 4-25. EFI Circuit (FLHR/C)

Table 4-17. Wire Harness Connectors

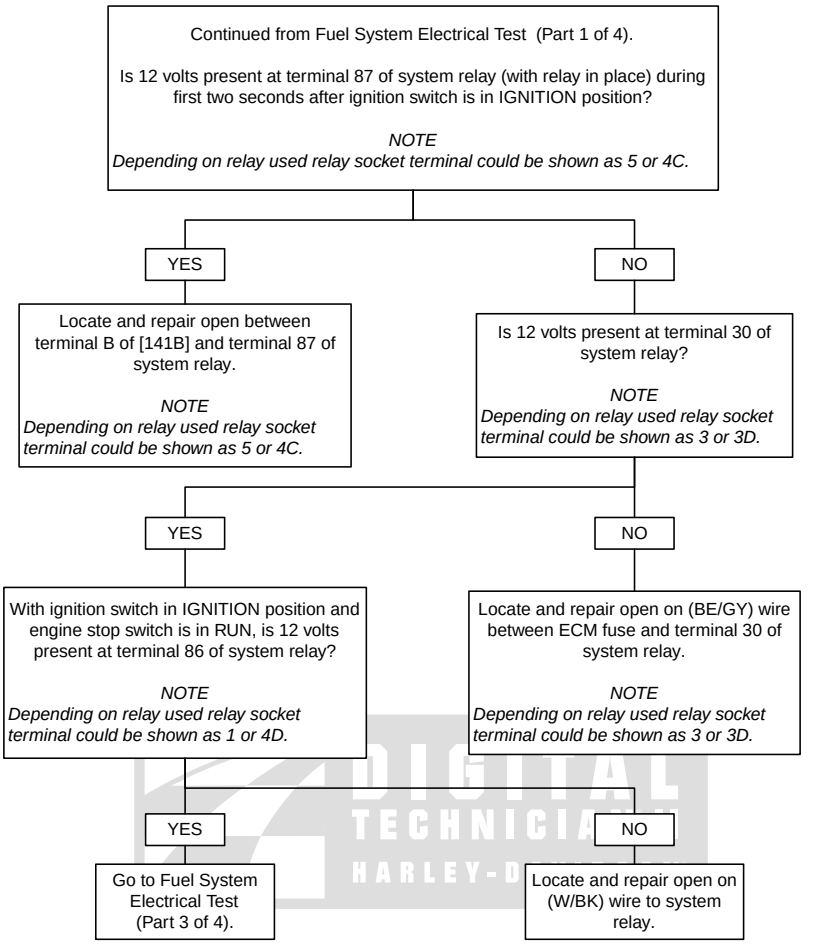
NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[13]	Fuel tank harness	All	4-place Multilock	Behind fuel tank (under seat)
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[33]	Ignition switch	FLHT/C/U/ FLTR	3-place Packard	Bottom of ignition switch housing
		FLHR/C	3-place Packard	Under console
[65]	VSS	All	3-place Delphi	Top of transmission case (under starter)
[78]	ECM	All	73-place Delphi	Under seat
[79]	CKP sensor	All	2-place Mini-Deutsch	Rear of lower front frame crossmember
[80]	TMAP sensor	All	4-place Delphi	Top of induction module
[83]	Ignition coil	All	4-place Delphi	Bottom front of battery tray
[84]	Front injector	All	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	All	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	All	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	All	4-place Deutsch	Under left side cover
[95]	Purge solenoid	All	2-place Delphi	Under seat
[133]	Jiffy stand sensor	All	3-place Molex (black)	Domestic (not used): Rear of lower front frame crossmember HDI: Rear of lower front frame cross-member
[137]	O2 sensor rear exhaust header	All	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	All	2-place Amp (Tyco)	Back of cross brace front frame downtubes
[141]	Fuel pump and fuel level sender	All	4-place Packard	Under console, on top of fuel tank canopy
[179]	Active exhaust actuator	All	5-place Amp (Tyco)	Domestic (not used): Under right side cover HDI: Under right side cover
[204]	TGS harness	FLTR	6-place Molex	Inner fairing right side below radio
		FLHT/C/U	6-place Molex	Inner right fairing support bracket
[211]	TCA	All	6-place Molex	Right side of engine (induction module)
[222]	Console ignition switch interconnect	FLHR/C	4-place Packard	Under seat
[224]	TGS	All	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)

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Fuel System Electrical Test (Part 1 of 4)

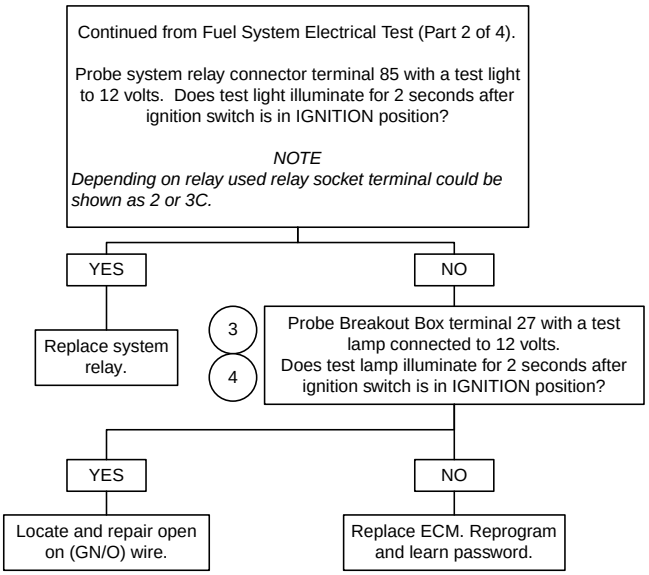


Fuel System Electrical Test (Part 2 of 4)



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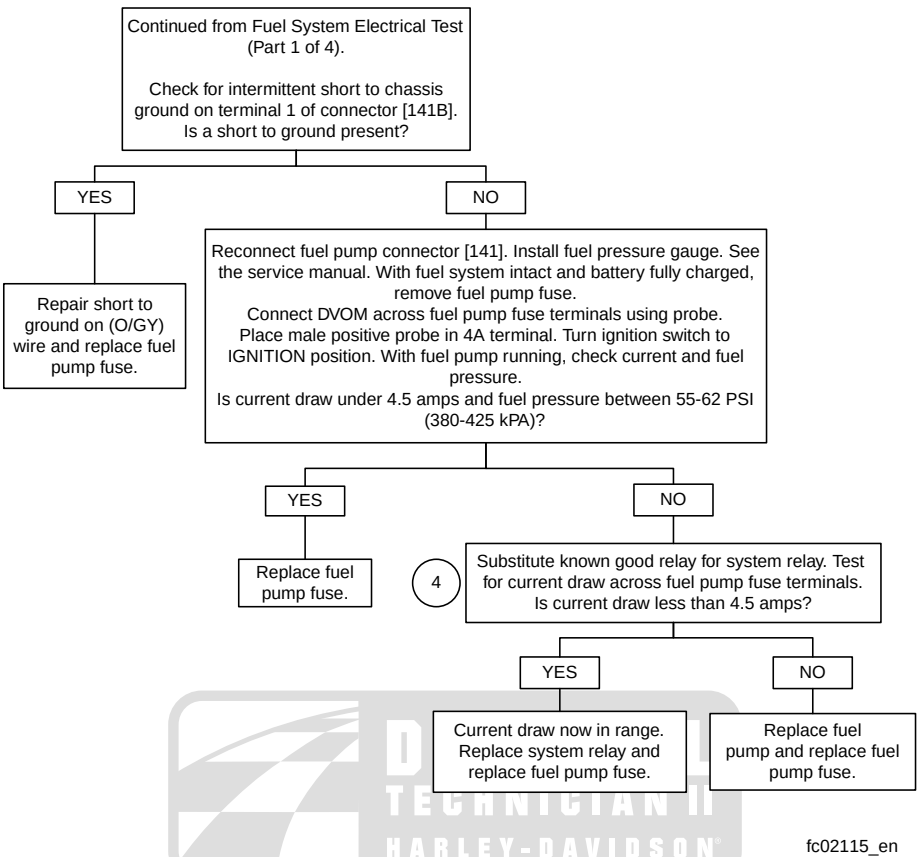
Fuel System Electrical Test (Part 3 of 4)



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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Fuel System Electrical Test (Part 4 of 4)



SYSTEM RELAY FAULT 4.13

GENERAL

System Relay

See Figure 4-26. With the ignition switch turned to IGNITION and the engine stop switch at RUN, the ECM energizes the system relay to complete the circuit to the in-tank fuel pump, ignition coil, and fuel injectors. They remain powered as long as the engine is cranking or running, and the ECM is receiving ignition reference pulses from the CKP sensor. If there are no reference pulses, the ECM de-energizes the system relay within 2 seconds after the ignition is turned to IGNITION or the engine has stalled, or immediately after the ignition is shut off.

Table 4-18. Code Description

DTC	DESCRIPTION
P1001	System relay coil open/low
P1002	System relay coil high/shorted
P1003	System relay contacts open
P1004	System relay contacts closed

Diagnostic Tips

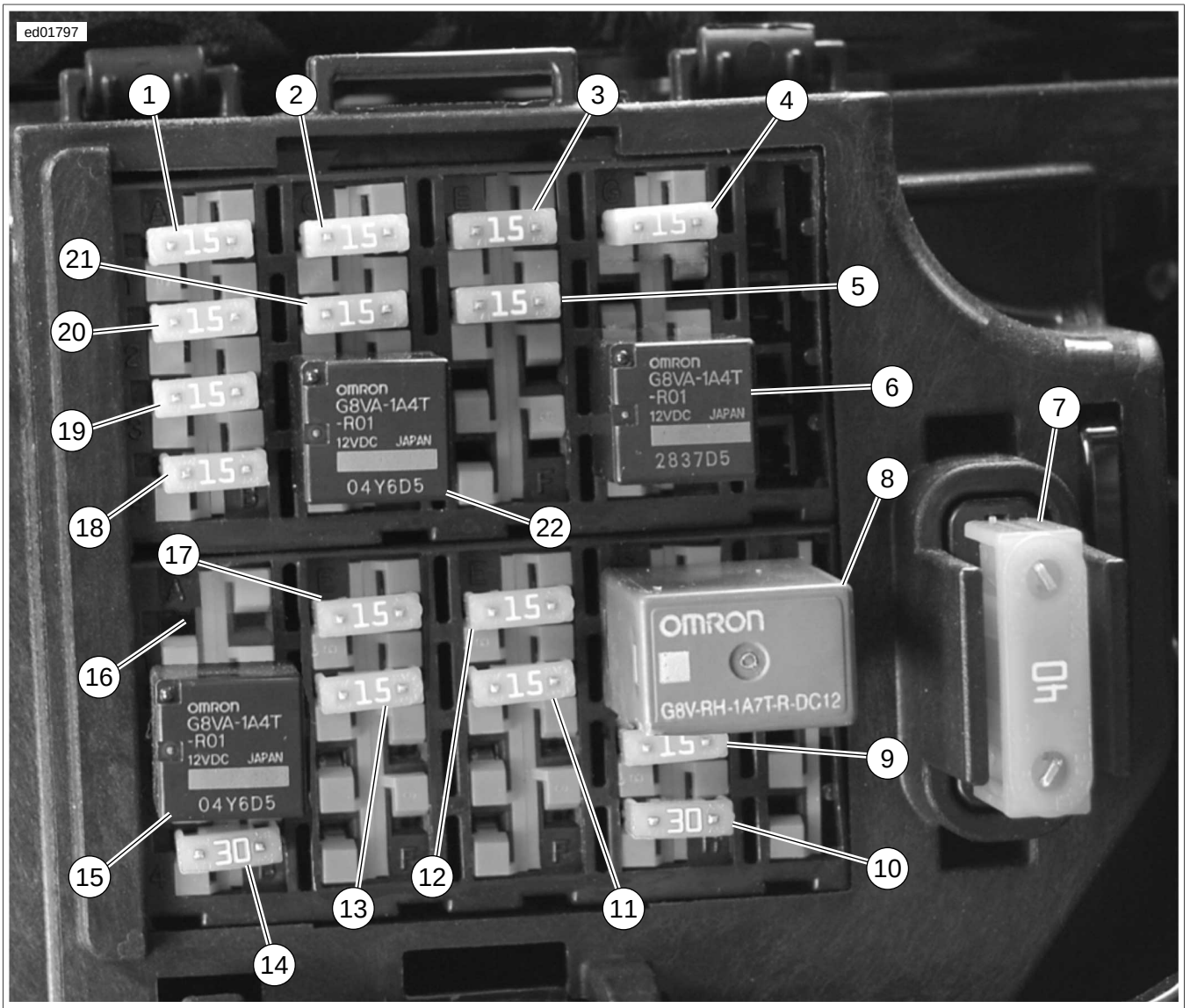
1. A relay can be tested using the motorcycle?s 12 Volt battery and a multimeter.
 a. Unplug the relay from the fuse block.
 b. Test for continuity between terminals 30 and 87. There should not be any continuity between these two terminals when the relay is not energized. If there is, this indicates stuck contacts which would cause a P1004 and the relay must be replaced.
 c. To energize the relay, connect relay terminal 85 to the negative battery terminal and relay terminal 86 to the positive battery terminal.

 NOTE

 Some relays contain internal diodes. If the applied voltage is not the correct polarity, the diode could be damaged.

 d. Check for continuity between terminals 30 and 87. A good relay shows continuity. A malfunctioning relay will not show continuity and must be replaced.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Brake/cruise
2. Accessory
3. P&A
4. Radio power/Siren
5. ECM power
6. Start relay
7. MAXIFUSE
8. Lighting relay
9. Spare
10. Spare
11. Lights
12. Ignition
13. Headlamp
14. ABS
15. Brake relay
16. P&A IGN (2A Max)
17. Instruments
18. Fuel pump
19. Exhaust control
20. Radio memory
21. Battery
22. System relay

Figure 4-26. Fuse and Relay Locations

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord.
2. Connect BREAKOUT BOX (Part No. HD-48637) to ECM. See 4.7 BREAKOUT BOX: EFI.

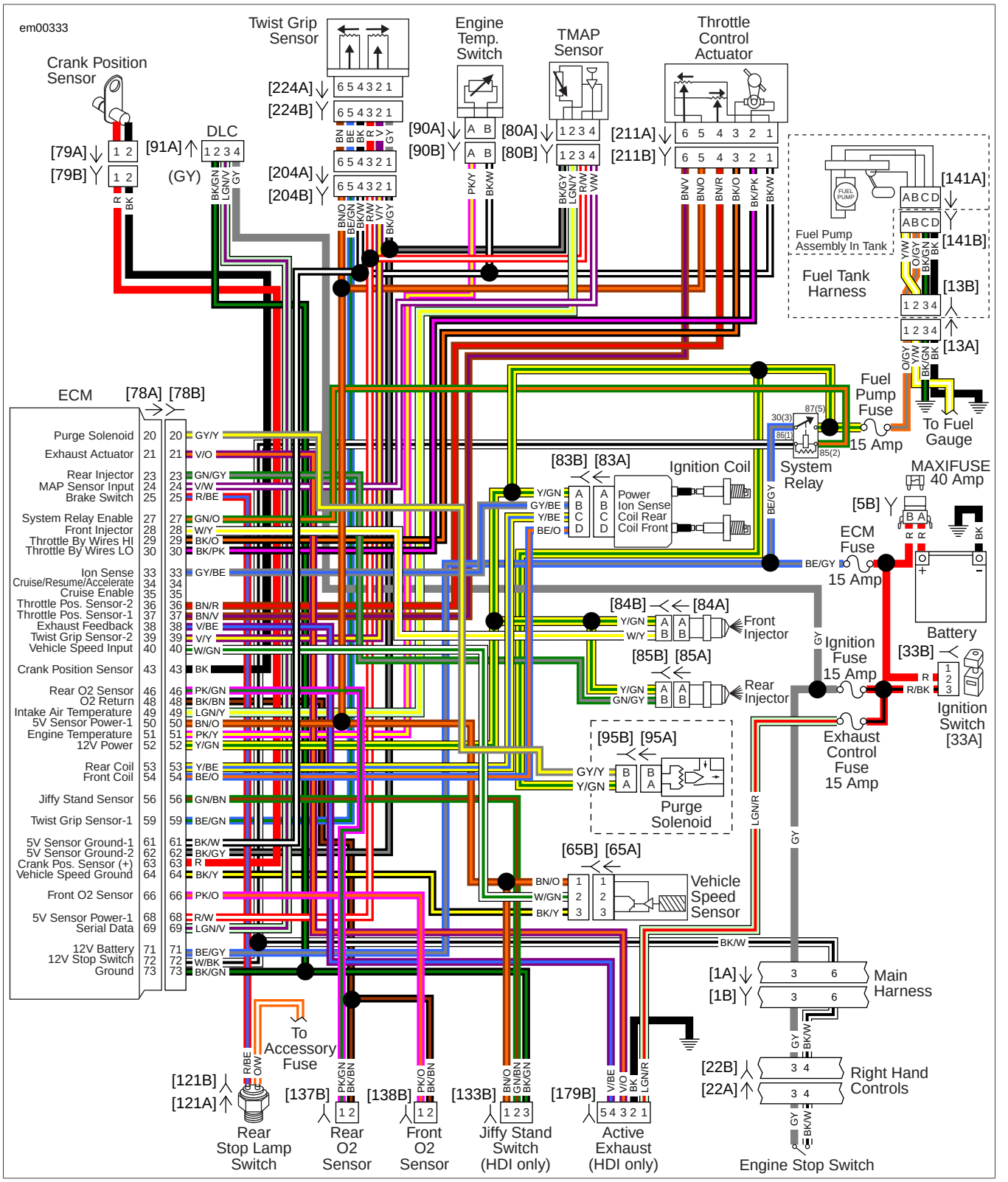


Figure 4-27. System Relay Circuit (FLHX, FLHT/C/U, FLTR)

Table 4-19. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	All	16-place Molex (black)	Inner fairing (right radio support bracket)
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[13]	Fuel tank harness	All	4-place Multilock	Behind fuel tank (under seat)
[22]	Right handlebar switches	FLHX, FLHT/C/U	12-place Molex (black)	Right fairing support bracket
		FLTR	12-place Molex (black)	Inner fairing (on left fairing support bracket)
[33]	Ignition switch	All	3-place Packard	Bottom of ignition switch housing
[65]	VSS	All	3-place Delphi	Top of transmission case (under starter)
[78]	ECM	All	73-place Delphi	Under seat
[79]	CKP sensor	All	2-place Mini-Deutsch	Rear of lower front frame crossmember
[80]	TMAP sensor	All	4-place Bosch	Top of induction module
[83]	Ignition coil	All	4-place Delphi	Bottom front of battery tray
[84]	Front injector	All	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	All	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	All	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	All	4-place Deutsch	Under left side cover
[95]	Purge solenoid	All	2-place Delphi	Under seat
[121]	Rear stop lamp switch	All	Spade terminal	Bottom of rear frame downtube (right side)
[133]	Jiffy stand sensor	All	3-place Molex (black)	Domestic (not used) HDI: Rear of front lower frame crossmember
[137]	O2 sensor rear exhaust header	All	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	All	2-place Amp (Tyco)	Back of cross brace front frame downtubes
[141]	Fuel pump and fuel level sender	All	4-place Packard	Under console (on top of fuel tank canopy)
[179]	Active exhaust actuator	All	5-place Amp (Tyco)	Domestic (not used): Under right side cover HDI: Under right side cover (behind electrical bracket)
[204]	TGS harness	All	6-place Molex	Inner fairing (right fairing support bracket)
[211]	TCA	All	6-place Molex	Right side of engine (induction module)
[224]	TGS	All	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)

DIGITAL TECHNICIAN HARLEY-DAVIDSON

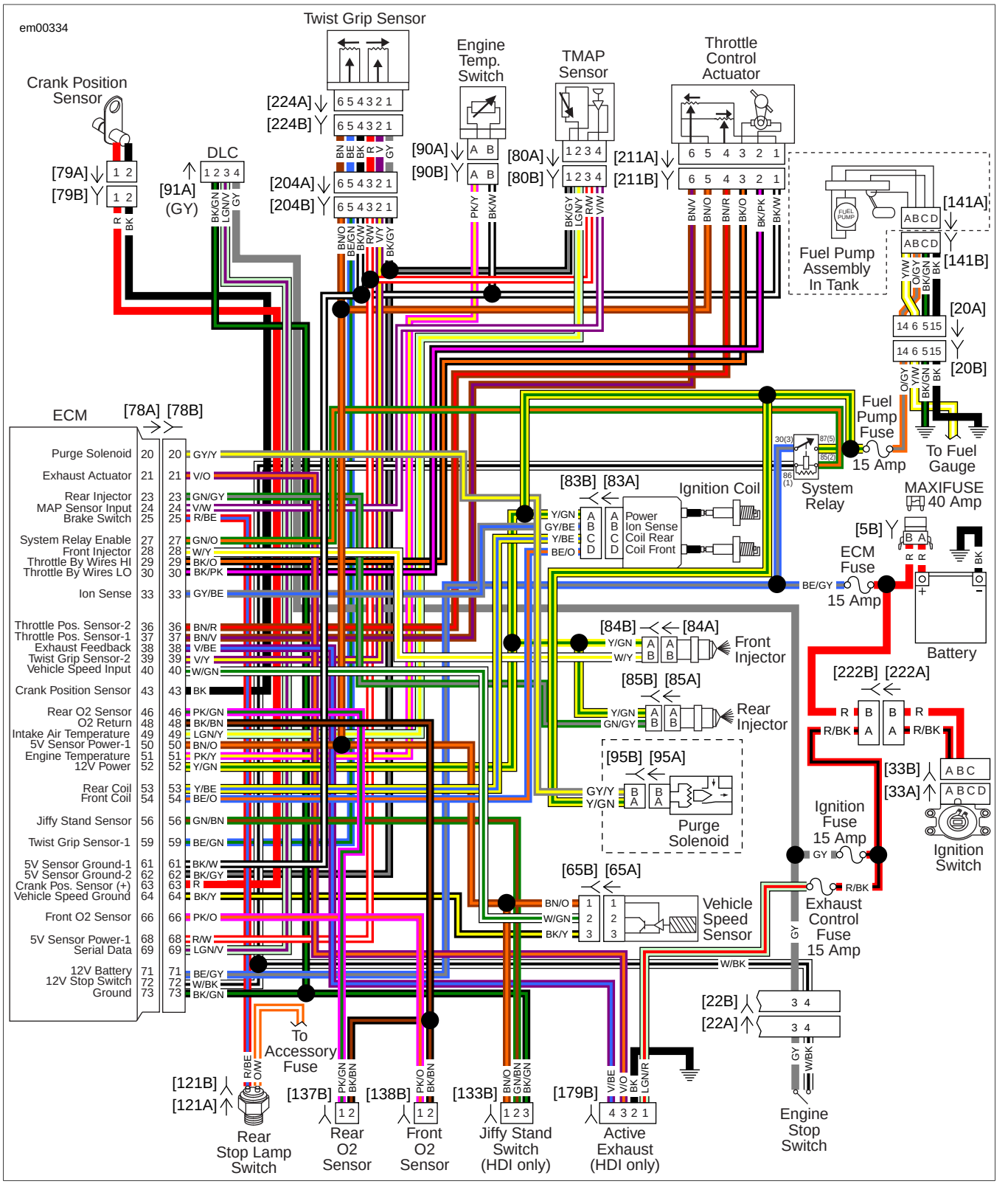


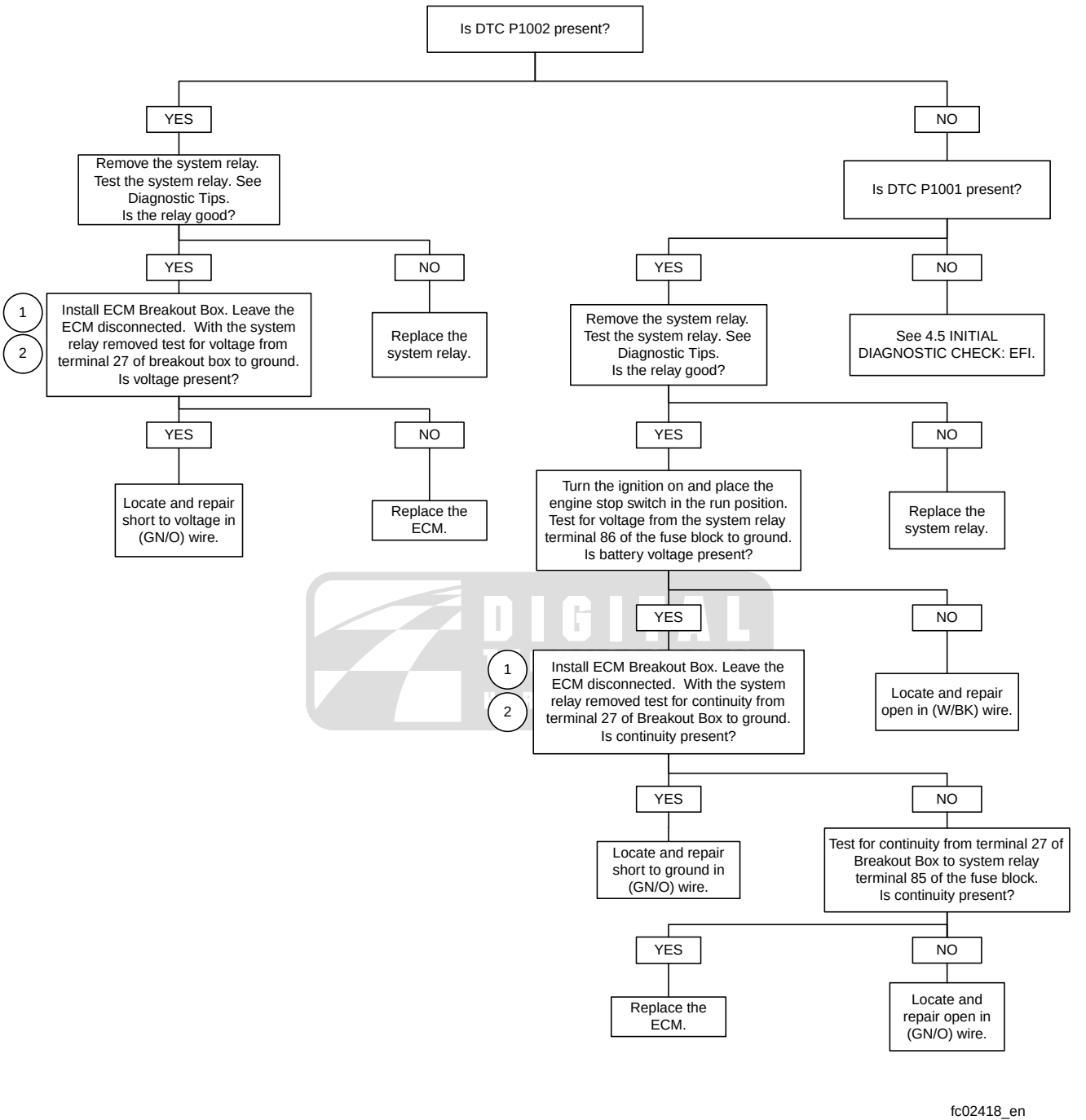
Figure 4-28. System Relay Circuit (FLHR/C)

Table 4-20. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[5]	MAXIFUSE	2-place Packard	Under left side cover
[13]	Fuel tank harness	4-place Multilock	Behind fuel tank (under seat)
[20]	Console harness	16-place Molex	Under seat
[22]	Right handlebar switches	6-place Molex (black)	Inside headlamp nacelle (fork stern nut lock plate right side)
[33]	Ignition switch	3-place Packard	Under console
[65]	VSS	3-place Delphi	Top of transmission case (under starter)
[78]	ECM	73-place Delphi	Under seat
[79]	CKP sensor	2-place Mini-Deutsch	Rear of front lower frame crossmember
[80]	TMAP sensor	4-place Bosch	Top of induction module
[83]	Ignition coil	4-place Delphi	Bottom front of battery tray
[84]	Front injector	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	4-place Deutsch	Under left side cover
[95]	Purge solenoid	2-place Delphi	Under seat
[121]	Rear stop lamp switch	Spade terminal	Bottom of rear frame downtube (right side)
[133]	Jiffy stand sensor	3-place Molex (black)	Domestic (not used) HDI: Rear of lower front frame cross-member
[137]	O2 sensor rear exhaust header	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	2-place Amp (Tyco)	Back of cross brace front frame down-tubes
[141]	Fuel pump and fuel level sender	4-place Packard	Top of fuel tank canopy (under con-sole)
[179]	Active exhaust actuator	5-place Amp (Tyco)	Domestic (not used) HDI: Under right side cover (behind electrical bracket)
[204]	TGS harness	6-place Molex	Inner fairing (right side below radio)
[211]	TCA	6-place Molex	Right side of engine (induction module)
[222]	Console ignition switch interconnect	4-place Packard	Under seat
[224]	TGS	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)

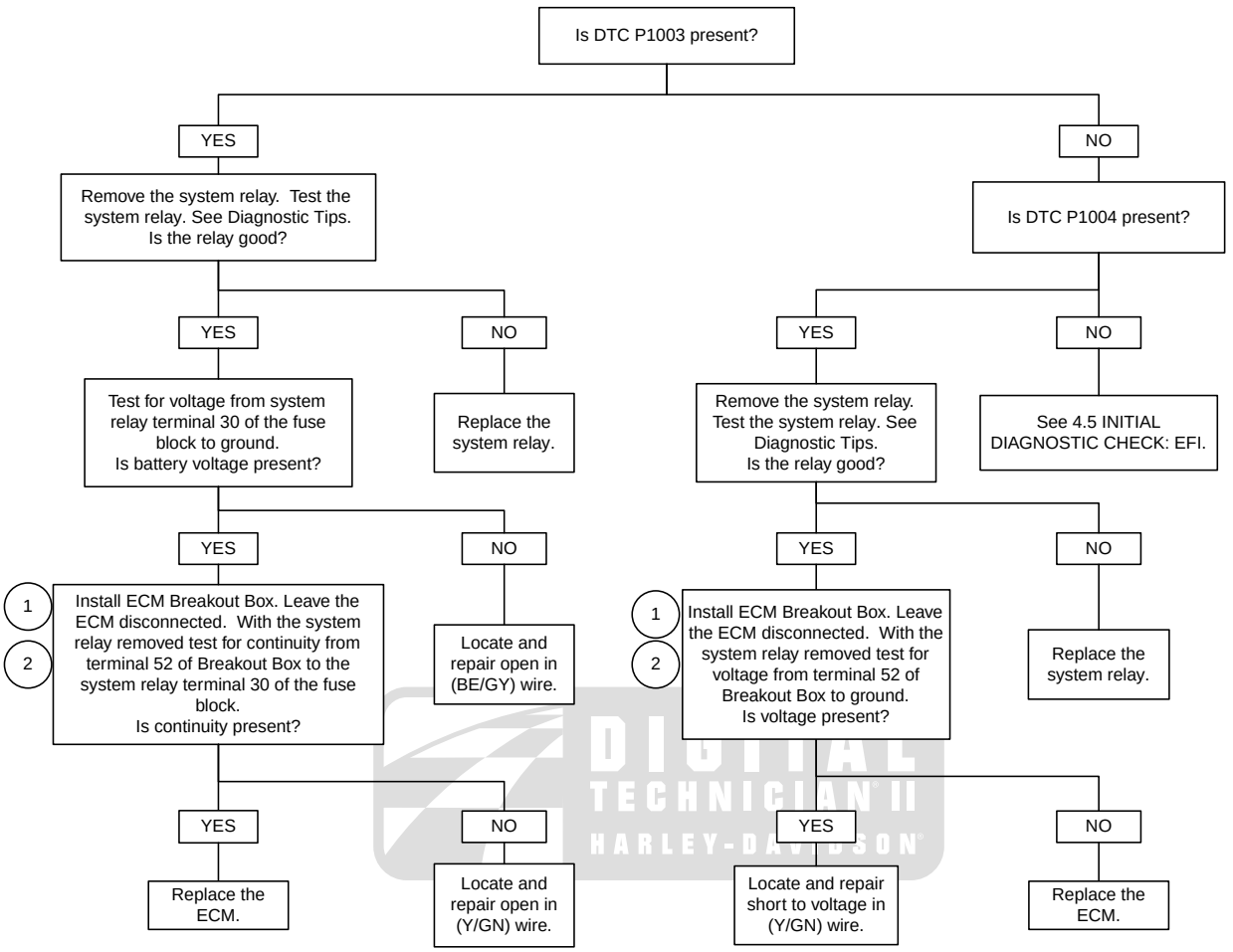
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DTCs P1001 and P1002



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DTCs P1003 and P1004



fc02419_en

MISFIRE AT IDLE OR UNDER LOAD 4.14

GENERAL

Misfire at Idle or Under Load

- Battery condition and connections may also cause misfires. See Battery in the service manual for more information.
- Fuel system problems may also cause misfires. See the service manual and then see symptom tables under 4.5 INITIAL DIAGNOSTIC CHECK: EFI.
- Mechanical problems with the engine may cause misfires. See Section 3 of the service manual for more information.
- Vehicle modifications including intake and exhaust may cause misfires.

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-26792	SPARK TESTER
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

⚠WARNING

Wipe up spilled fuel and dispose of rags in a suitable manner. An open spark around gasoline could cause a fire or explosion, resulting in death or serious injury. (00518b)

1. Connect BREAKOUT BOX (Part No. HD-48637) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

NOTE

Engine will not spark with both spark plugs removed. When checking for spark, use SPARK TESTER (Part No. HD-26792) with both plugs installed.

2. See Figure 4-29. A SPARK TESTER (Part No. HD-26792) must be used to verify adequate secondary voltage (25,000 volts) at the spark plug.
 a. Turn ignition switch off.
 b. Remove spark plug cable from spark plug. Visually check plug condition.
 c. Attach cable to SPARK TESTER (Part No. HD-26792). Clip tester to cylinder head bolt.
 d. While cranking engine, watch for spark to jump tester gap on leads.
 e. Install and repeat procedure on other spark plug cable.

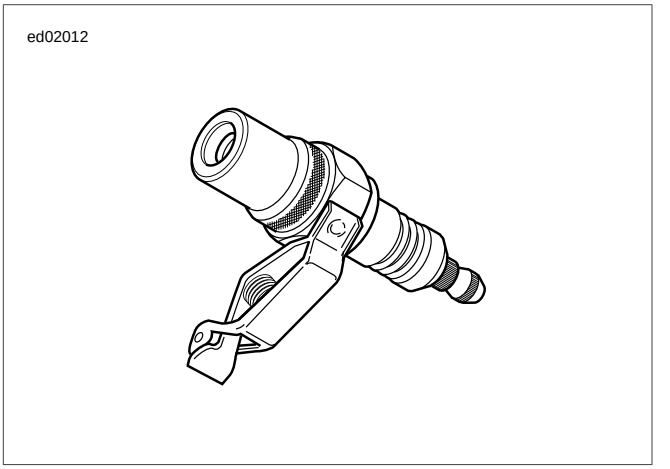


Figure 4-29. Spark Tester

Table 4-21. Spark Plug Cables

LOCATION	LENGTH	RESISTANCE
Front	16.5-17 in. (419-431 mm)	4125-11334 Ohms
Rear	34.5-35 in. (876-889 mm)	8625-23334 Ohms

3. Perform spark plug cable resistance test.
 a. Remove spark plug cable from spark plug and ignition coil. For best results, use needle nose pliers for removal/installation on coil. Gently grasp cable as close to terminals as possible.
 b. Using an ohmmeter, touch probes to terminals on each end of the spark plug cable.
 c. Compare resistance values to Table 4-21. Replace cables not meeting specifications. Install and repeat procedure on other spark plug cable.
4. If carbon tracking is evident on outside of coil towers, replace ignition coil and inspect spark plug cables. Cables must be clean and tight. Excessive cable resistance or faulty connections can cause coil damage.
5. This test can also be performed by substituting a known good coil for one causing the no spark condition. The coil does not require full installation to be functional. Verify faulty coil by performing resistance test. See ignition coil in the service manual.
6. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), red pin probe and patch cord to relay and gray pin probe and patch cord to the ignition coil connector [83B].

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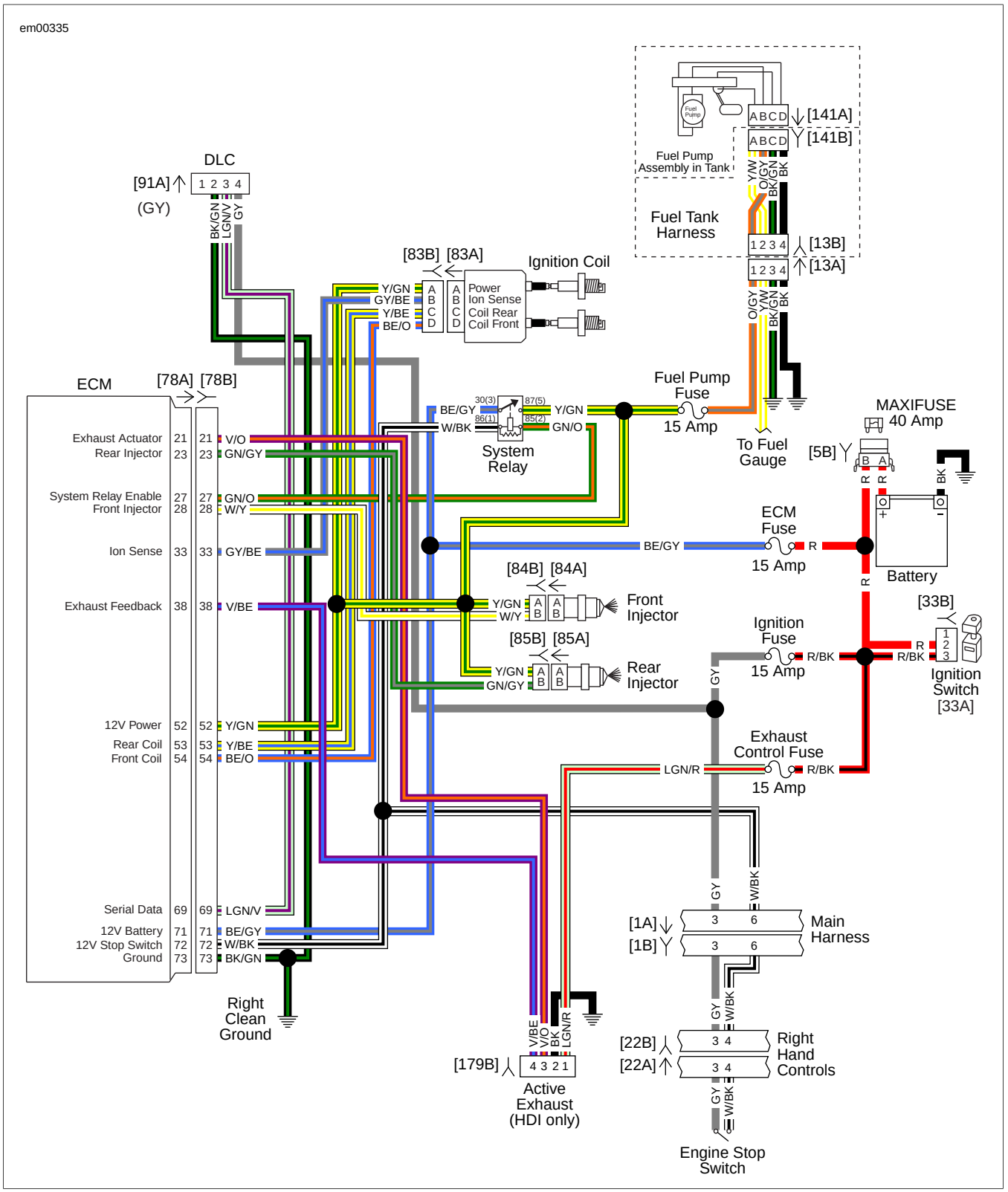


Figure 4-30. Ignition Coil Circuit Diagram (FLHX, FLHT/C/U, FLTR)

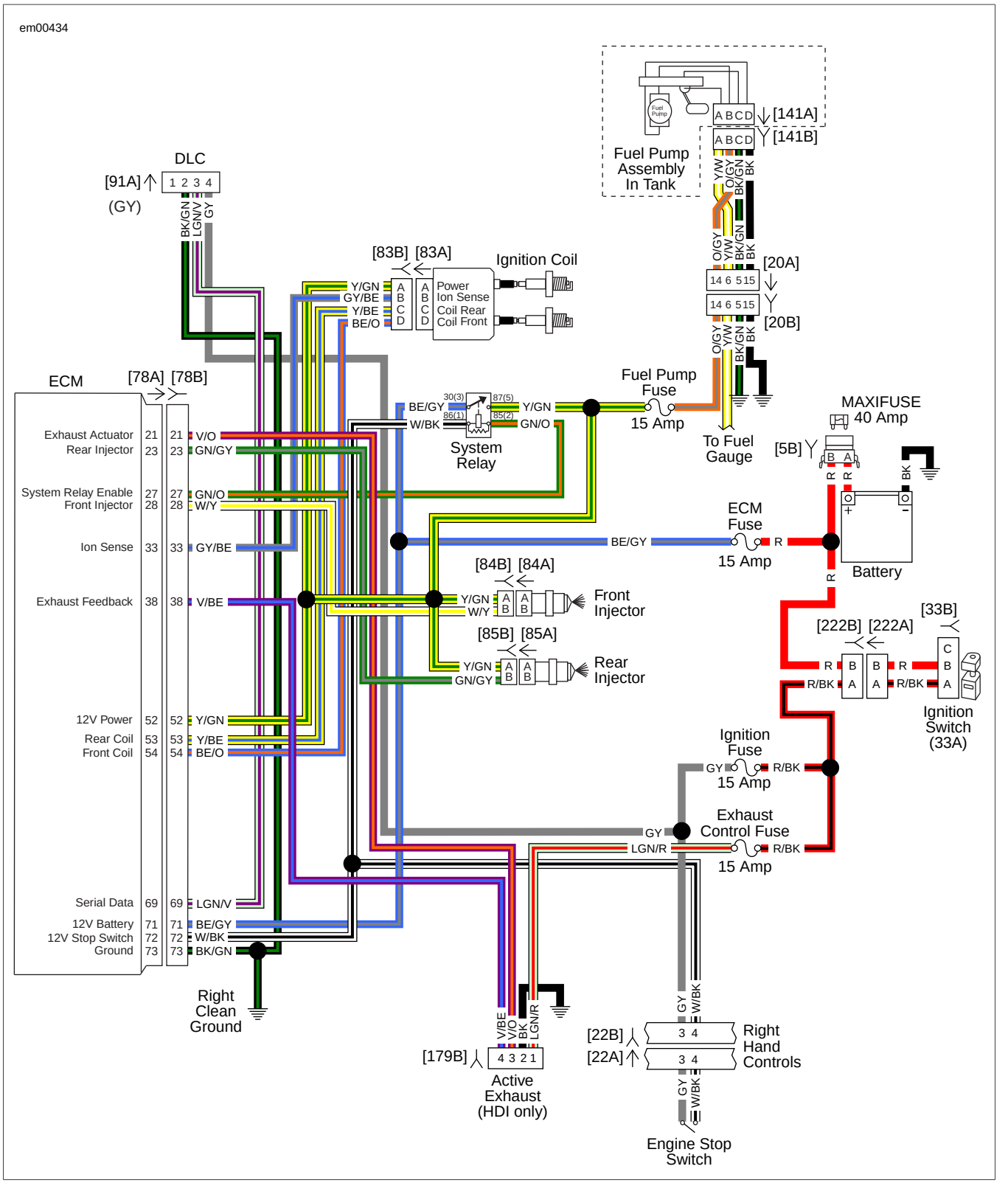


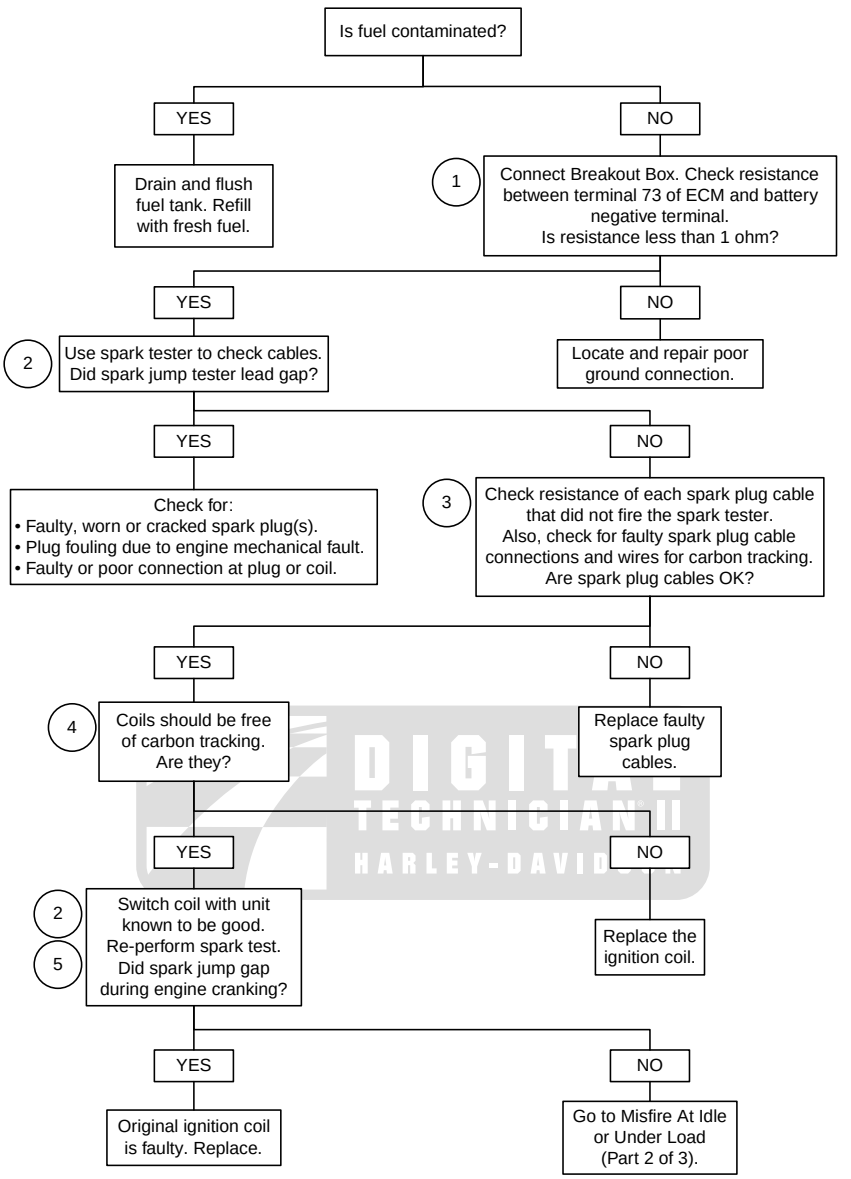
Figure 4-31. EFI Circuit (FLHR/C)

Table 4-22. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side below radio
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[13]	Fuel tank harness	All	4-place Multilock	Behind fuel tank (under seat)
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[22]	Right handlebar switches	FLHR/C	6-place Molex (Black)	Inside headlamp nacelle fork stem nut lock plate (right side)
		FLHT/C/U/X	12-place Molex (Black)	Inner fairing - right fairing support bracket
		FLTR	12-place Molex (Black)	Inner fairing - left fairing support bracket
[33]	Ignition switch	FLHT/C/U FLTR	3-place Packard	Bottom of ignition switch housing
		FLHR/C	3-place Packard	Under console
[78]	ECM	All	73-place Delphi	Under seat
[83]	Ignition coil	All	4-place Delphi	Bottom front of battery tray
[84]	Front injector	All	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	All	2-place Delphi	Below fuel tank (left side)
[91]	DLC	All	4-place Deutsch	Under left side cover
[141]	Fuel pump and fuel level sender	FLHX FLHT/C/U	4-place Packard	Under console on top of fuel tank canopy
		FLHR/C FLTR	4-place Packard	Top of canopy (under console)
[179]	Active exhaust actuator	All	5-place Amp (Tyco)	Domestic (not used)
				HDI: Under right side cover
[222]	Console ignition switch interconnect	FLHR/C	4-place Packard	Under seat

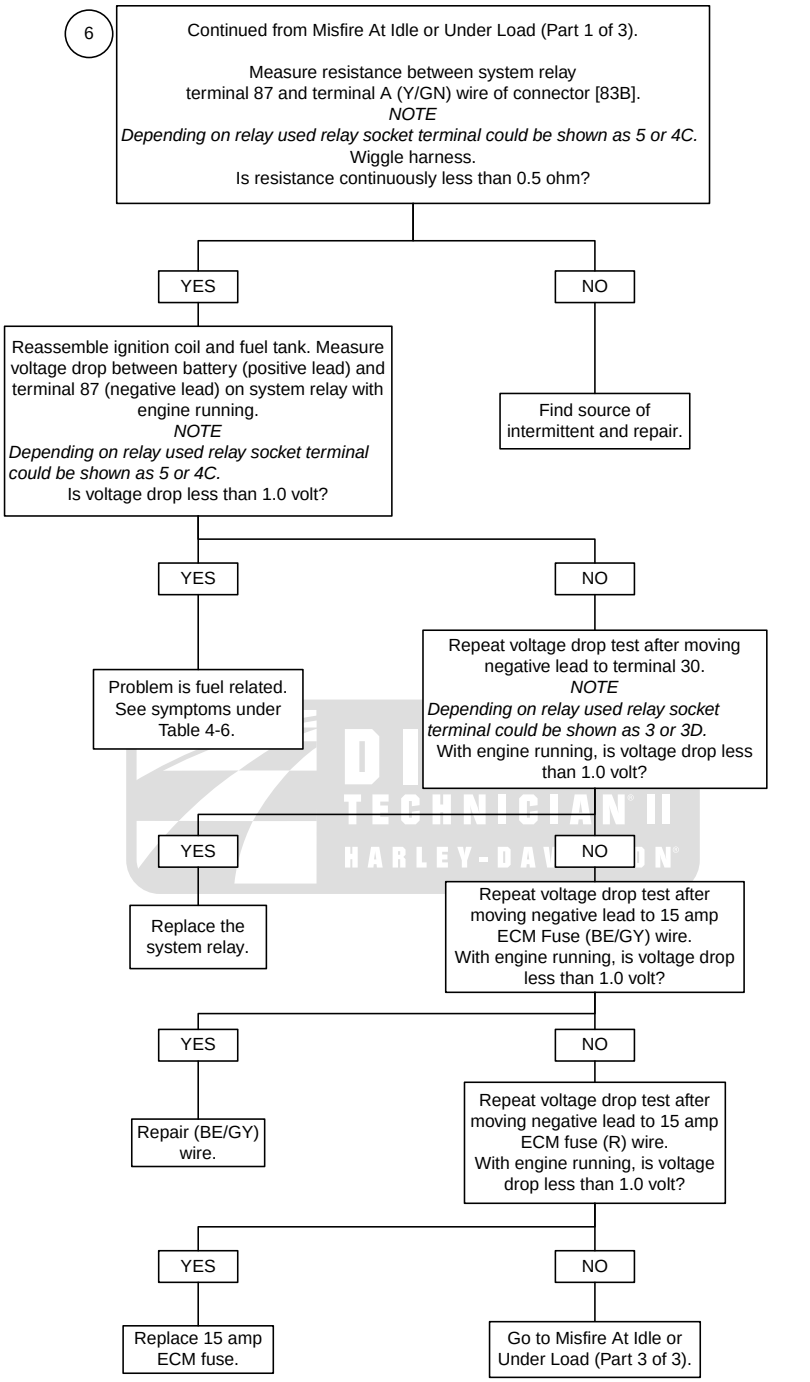
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Misfire at Idle or Under Load (Part 1 of 3)



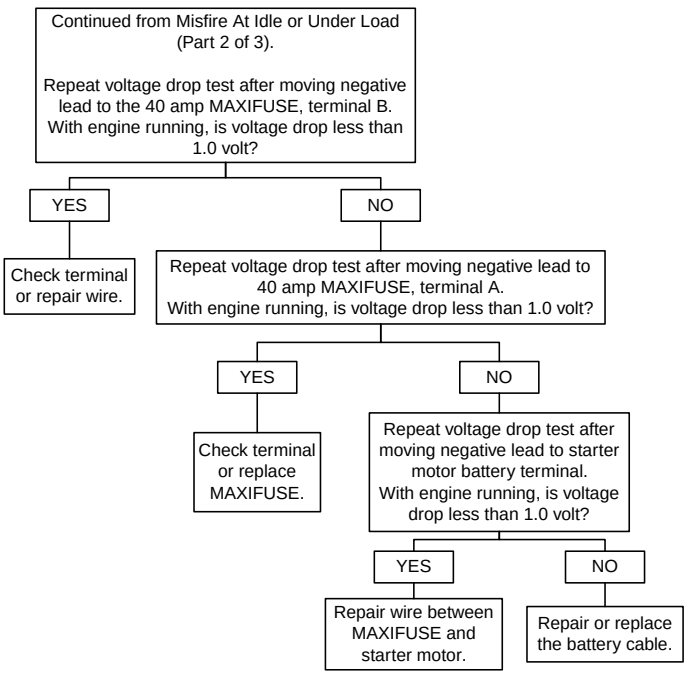
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Misfire at Idle or Under Load (Part 2 of 3)



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Misfire at Idle or Under Load (Part 3 of 3)



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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

COMBUSTION ABSENT/INTERMITTENT 4.15

GENERAL

Diagnostic Trouble Codes P1353, P1356, P1357, P1358: No Combustion

See Figure 4-32. A feedback voltage signal in the secondary ignition circuit detects the presence of combustion each time a cylinder fires on ECM terminal 33. For diagnostic purposes, this signal is only analyzed under load above 2000 RPM where it may be easily measured. Failure to detect combustion at high speed and load means one of following conditions exist.

- Cylinder is truly misfiring.
- There is a lack of continuity in the ignition coil secondary circuit.

Table 4-23. Code Description

DTC	DESCRIPTION
P1353	Front cylinder no combustion
P1356	Rear cylinder no combustion
P1357	Intermittent secondary front
P1358	Intermittent secondary rear

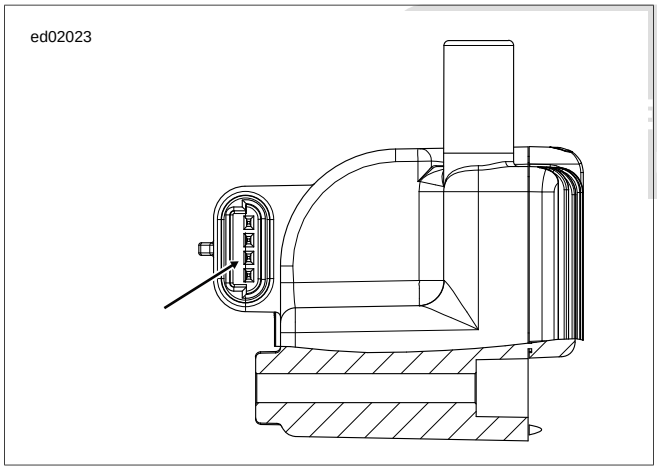


Figure 4-32. Ignition Coil

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
2. Spark plugs must be correct Harley-Davidson resistor type specified for this model.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes and patch cords.
4. Perform spark plug cable resistance test.
 a. Remove spark plug cable from spark plug and ignition coil. For best results, use a needle nose pliers for removal/installation on coil. Gently grasp cable as close to terminals as possible.
 b. Using an ohmmeter, touch probes to terminals on each end plug wire.
 c. Compare resistance values to Table 4-24. Replace cables not meeting specifications. Reinstall and repeat procedure on other spark plug cable.

Table 4-24. Spark Plug Cables

LOCATION	LENGTH	RESISTANCE
Front	16.5-17 in. (419-431 mm)	4125-11334 Ohms
Rear	34.5-35 in. (876-889 mm)	8625-23334 Ohms

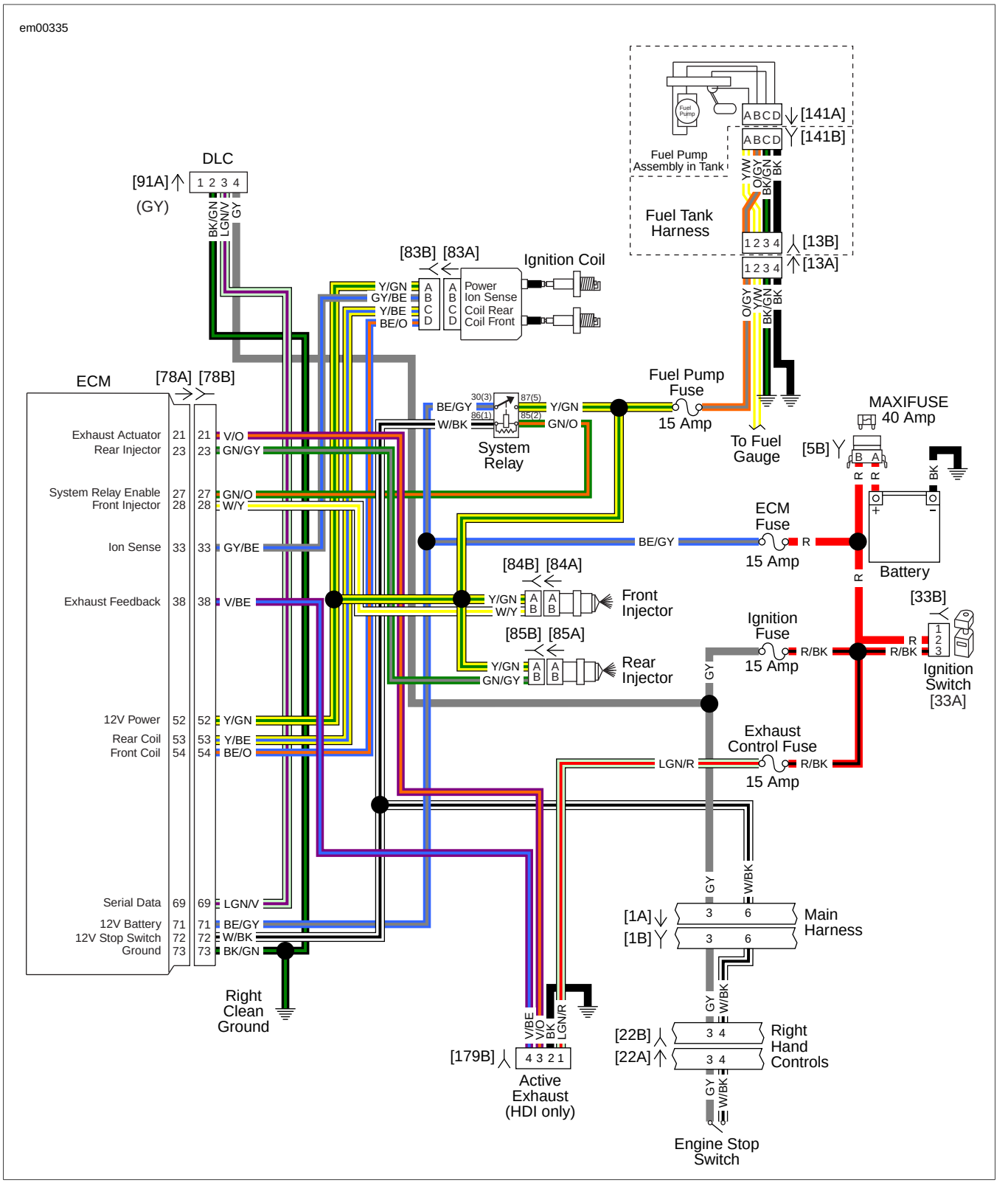


Figure 4-33. EFI Circuit (FLHX, FLHT/C/U, FLTR)

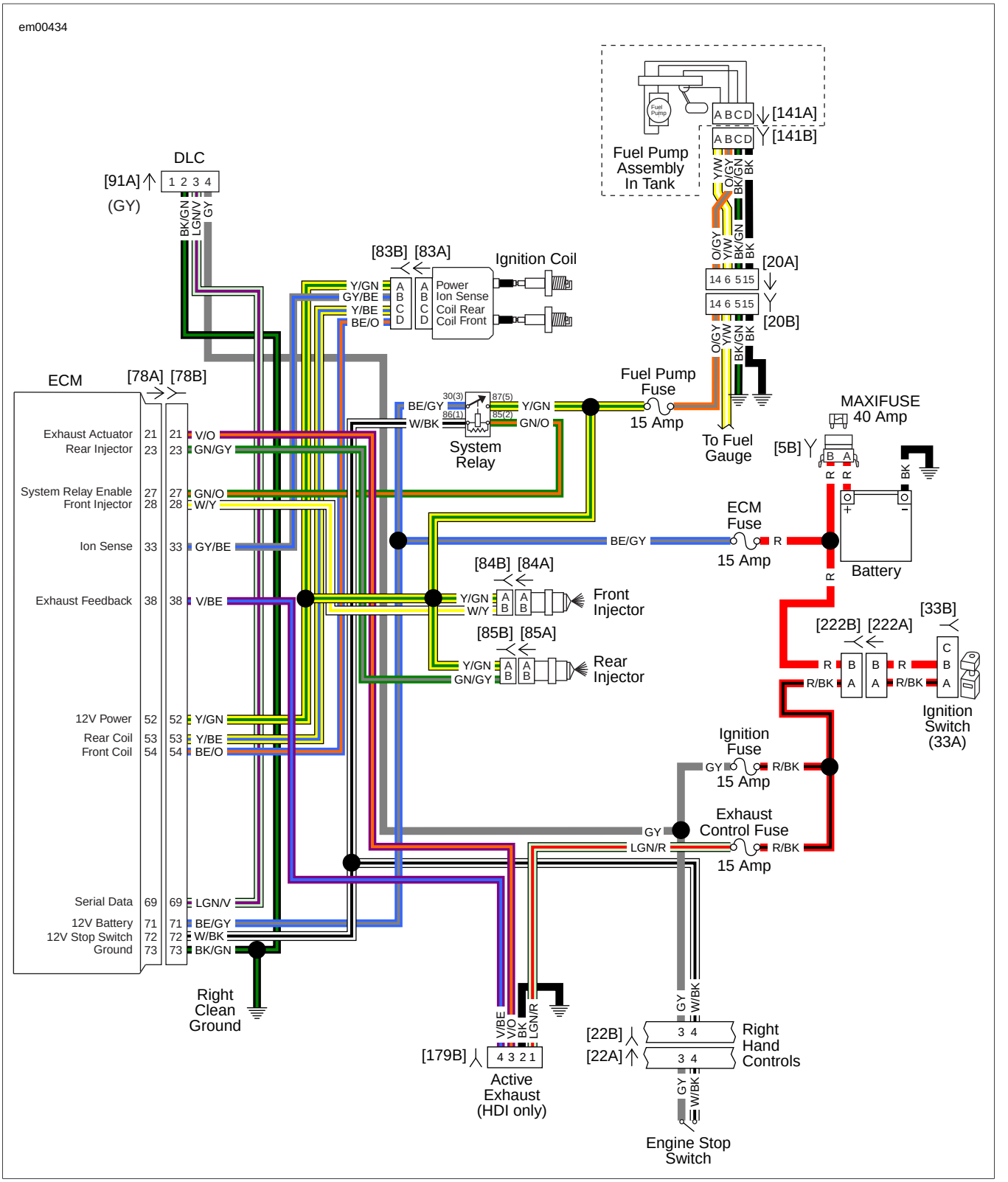


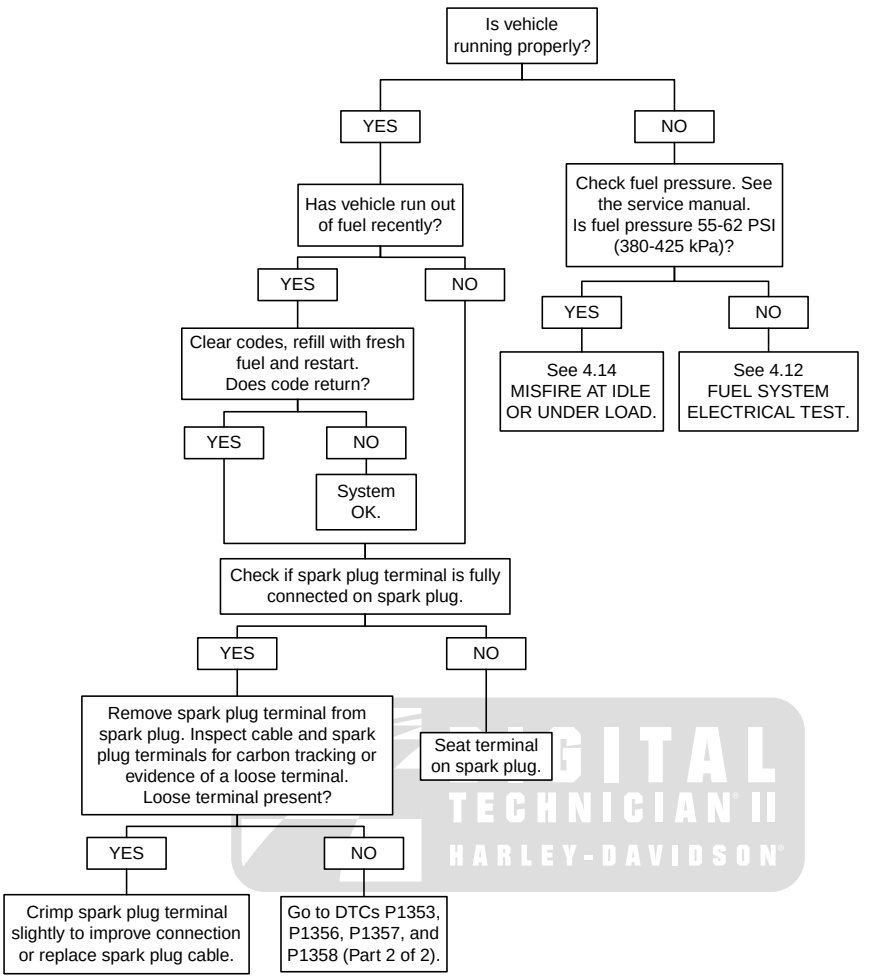
Figure 4-34. EFI Circuit (FLHR/C)

Table 4-25. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side below radio
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[13]	Fuel tank harness	All	4-place Multilock	Behind fuel tank (under seat)
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[22]	Right handlebar switches	FLHR/C	6-place Molex (Black)	Inside headlamp nacelle fork stem nut lock plate (right side)
		FLHT/C/U/X	12-place Molex (Black)	Inner fairing - right fairing support bracket
		FLTR	12-place Molex (Black)	Inner fairing - left fairing support bracket
[33]	Ignition switch	FLHT/C/U FLTR	3-place Packard	Bottom of ignition switch housing
		FLHR/C	3-place Packard	Under console
[78]	ECM	All	73-place Delphi	Under seat
[83]	Ignition coil	All	4-place Delphi	Bottom front of battery tray
[84]	Front injector	All	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	All	2-place Delphi	Below fuel tank (left side)
[91]	DLC	All	4-place Deutsch	Under left side cover
[141]	Fuel pump and fuel level sender	FLHX FLHT/C/U	4-place Packard	Under console on top of fuel tank canopy
		FLHR/C FLTR	4-place Packard	Top of canopy (under console)
[179]	Active exhaust actuator	All	5-place Amp (Tyco)	Domestic (not used)
				HDI: Under right side cover
[222]	Console ignition switch interconnect	FLHR/C	4-place Packard	Under seat

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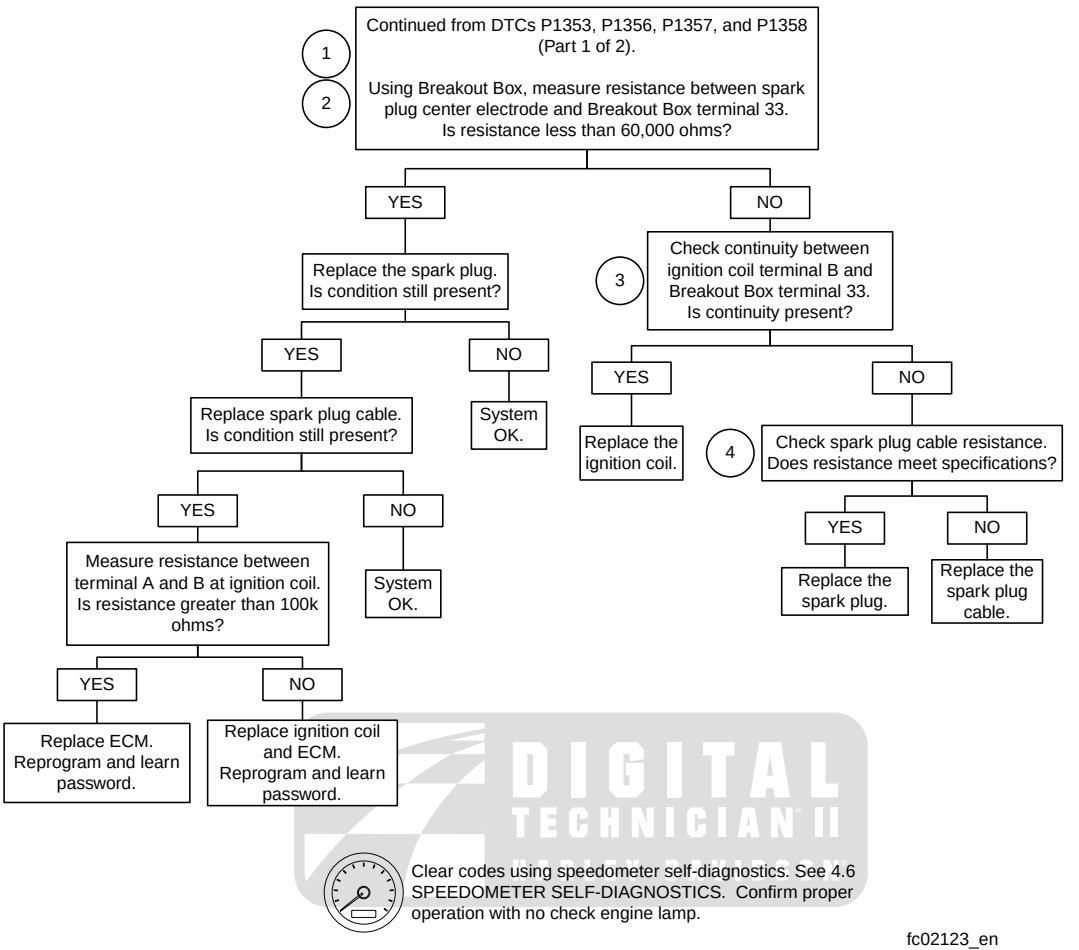
DTCs P1353, P1356, P1357, and P1358 (Part 1 of 2)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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DTCs P1353, P1356, P1357, and P1358 (Part 2 of 2)



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DTC P0107, P0108, P0112, P0113 4.16

GENERAL

See Figure 4-35. The TMAP sensor provides the functions of both an IAT sensor and a MAP sensor in one unit.

The TMAP sensor is supplied 5 volts from ECM terminal 68 and sends MAP and IAT signals back to ECM terminals 24 and 49 respectively. Refer to Table 4-26.

Table 4-26. Code Description

DTC	DESCRIPTION
P0107	MAP sensor open/low
P0108	MAP sensor high
P0112	IAT sensor voltage low
P0113	IAT sensor open/high

TMAP: MAP Signal

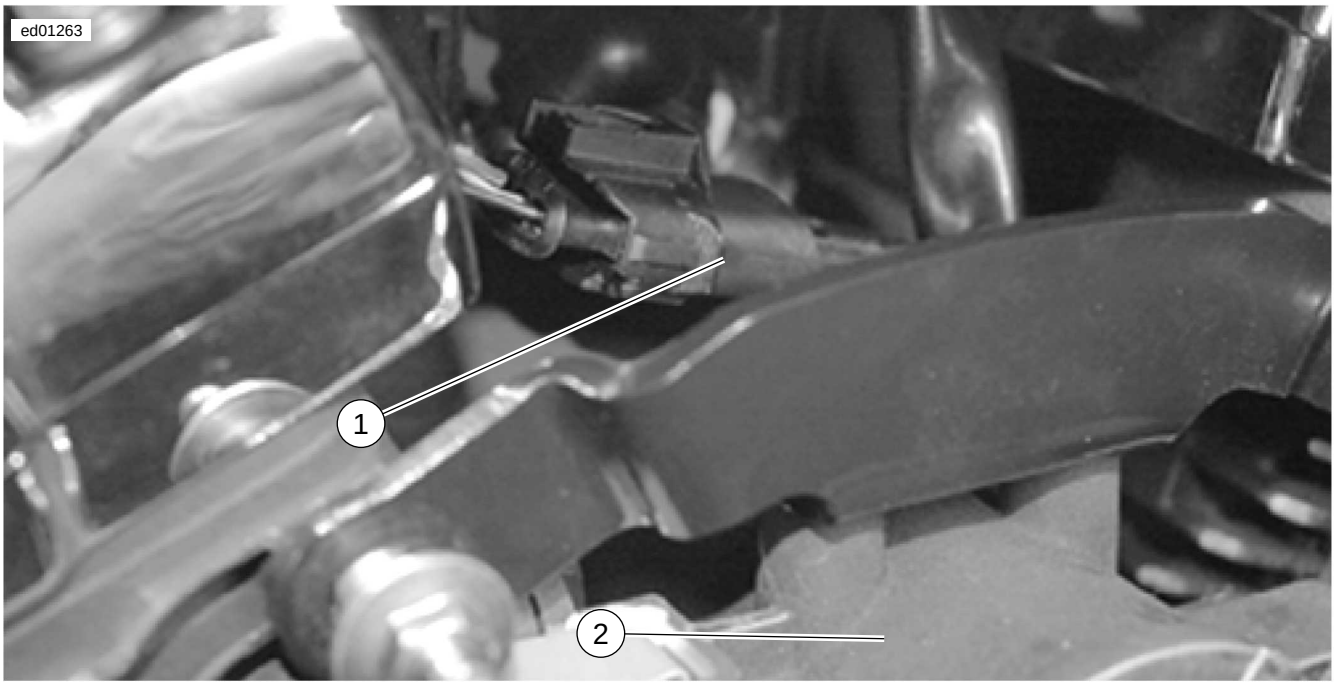
The MAP signal varies in accordance with engine vacuum and atmospheric pressure. Changes in atmospheric pressure are influenced by weather and altitude.

TMAP: IAT Signal

The IAT portion of the TMAP sensor is a thermistor device, meaning that at a specific temperature, it will have a specific resistance across its terminals. As this resistance varies, so does the voltage on terminal 49 of the ECM.

- At high temperatures, the resistance of the IAT sensor is very low, which effectively lowers the signal voltage on terminal 49.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5 volts.

The ECM monitors this voltage to compensate for various operating conditions.



1. **TMAP**
2. **Induction Module**

Figure 4-35. TMAP Sensor Location

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-23738	VACUUM PUMP
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Tips: MAP Portion of TMAP Sensor

- DTCs P0107 or P0108 will set if the MAP sensor signal is out of range. DTC P0108 can only be detected with the engine running.
- MAP sensor output check. Using the VACUUM PUMP (Part No. HD-23738), apply a vacuum to the pressure port of the TMAP sensor. The MAP signal voltage should lower as the vacuum is applied.
- The TMAP and TP sensors are connected to the same reference line (+5V Vref). If the reference line goes to ground or open, multiple codes will be set (DTCs P0107, P0108, P0122, P0123, P1501, and P1502).

Diagnostic Tips: IAT Portion of TMAP Sensor

Check the following conditions:

- **Poor connection**: Inspect ECM and harness connector [78] for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Perform** 4.8 WIGGLE TEST **to locate intermittents**: If connections and harness check out OK, use a DVOM to check the IAT sensor voltage reading while moving related connectors and wiring harnesses. If the failure is induced, then the IAT sensor voltage reading will change.
- **Shifted sensor**: Refer to Table 4-27. This table may be used to test the IAT sensor at various temperature levels in order to evaluate the possibility of a shifted (out-of-calibration) sensor which may result in driveability problems.
- An intermittent may be caused by poor connection, rubbed through wire insulation or an inoperative wire within the wire's insulation.

Diagnostic Notes: TMAP Sensor

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes and patch cords.
3. Connect BREAKOUT BOX (Part No. HD-48637) to main wire harness only (leave ECM disconnected). See 4.7 BREAKOUT BOX: EFI.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin socket probes and patch cords.
5. Replace TMAP sensor. See the service manual.

Table 4-27. TMAP: IAT Sensor Table

TEMP °C	OHMS	VOLTAGE	TEMP °F
-20	15614	4.7	-4
-10	9426	4.5	14
0	5887	4.3	32
10	3791	4.0	50
20	2511	3.6	68
25	2063	3.4	77
30	1715	3.2	86
40	1200	2.7	104
50	851	2.3	122
60	612	1.9	140
70	446	1.5	158
80	330	1.2	176
90	246	1.0	194
100	186	0.8	212

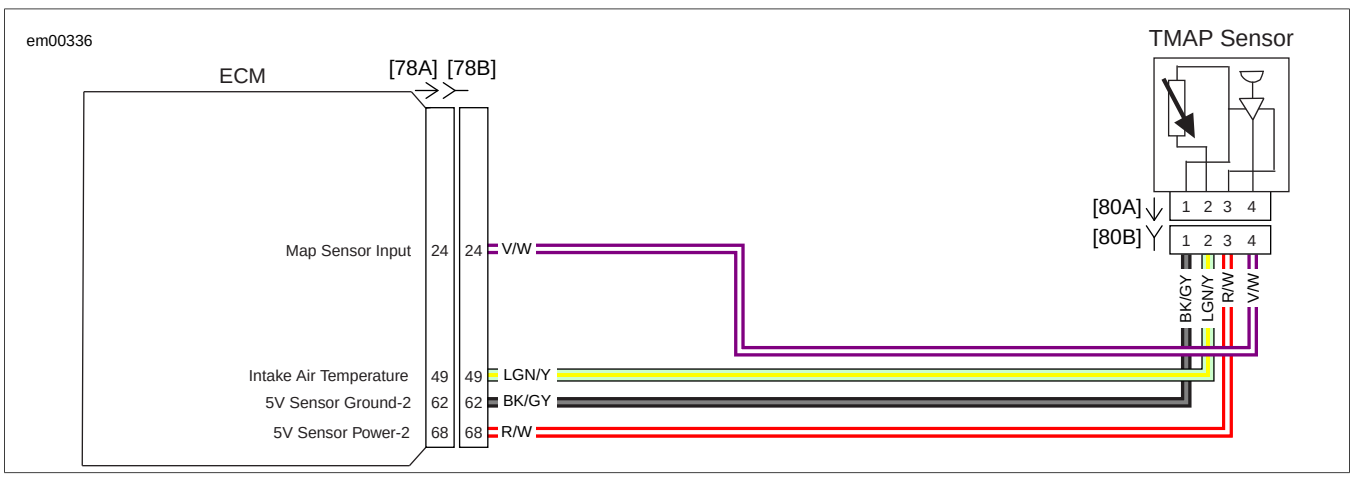


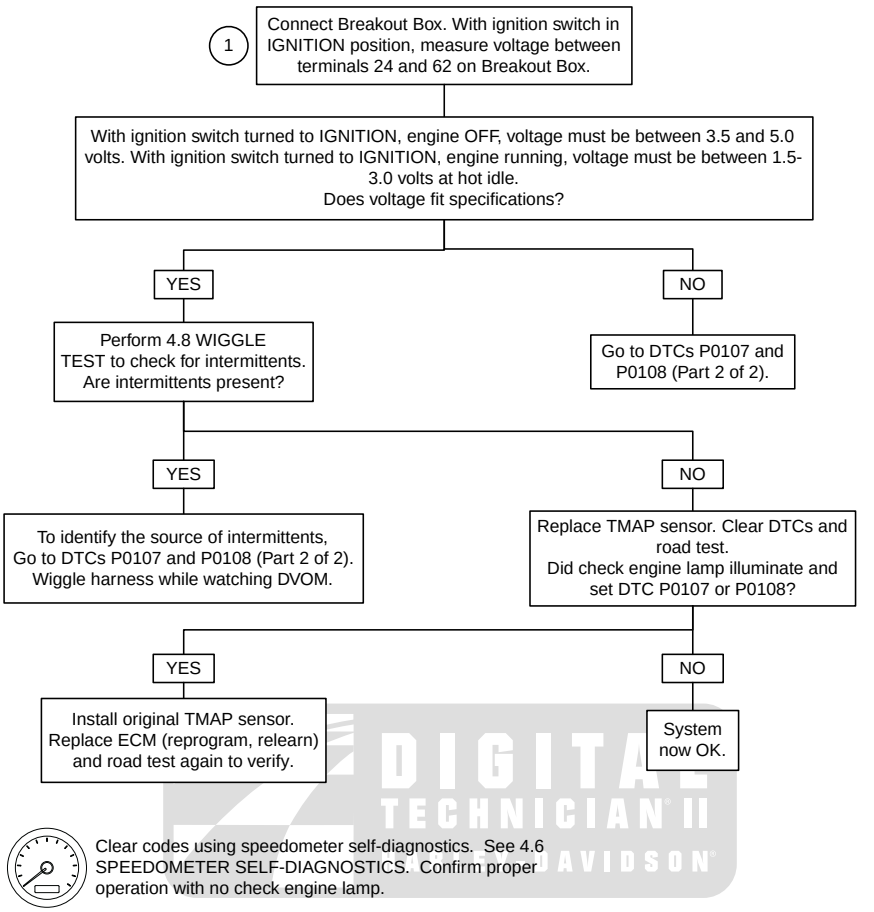
Figure 4-36. TMAP Sensor Circuit

Table 4-28. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	73-place Delphi	Under seat
[80]	TMAP sensor	4-place Bosch	Top of induction module

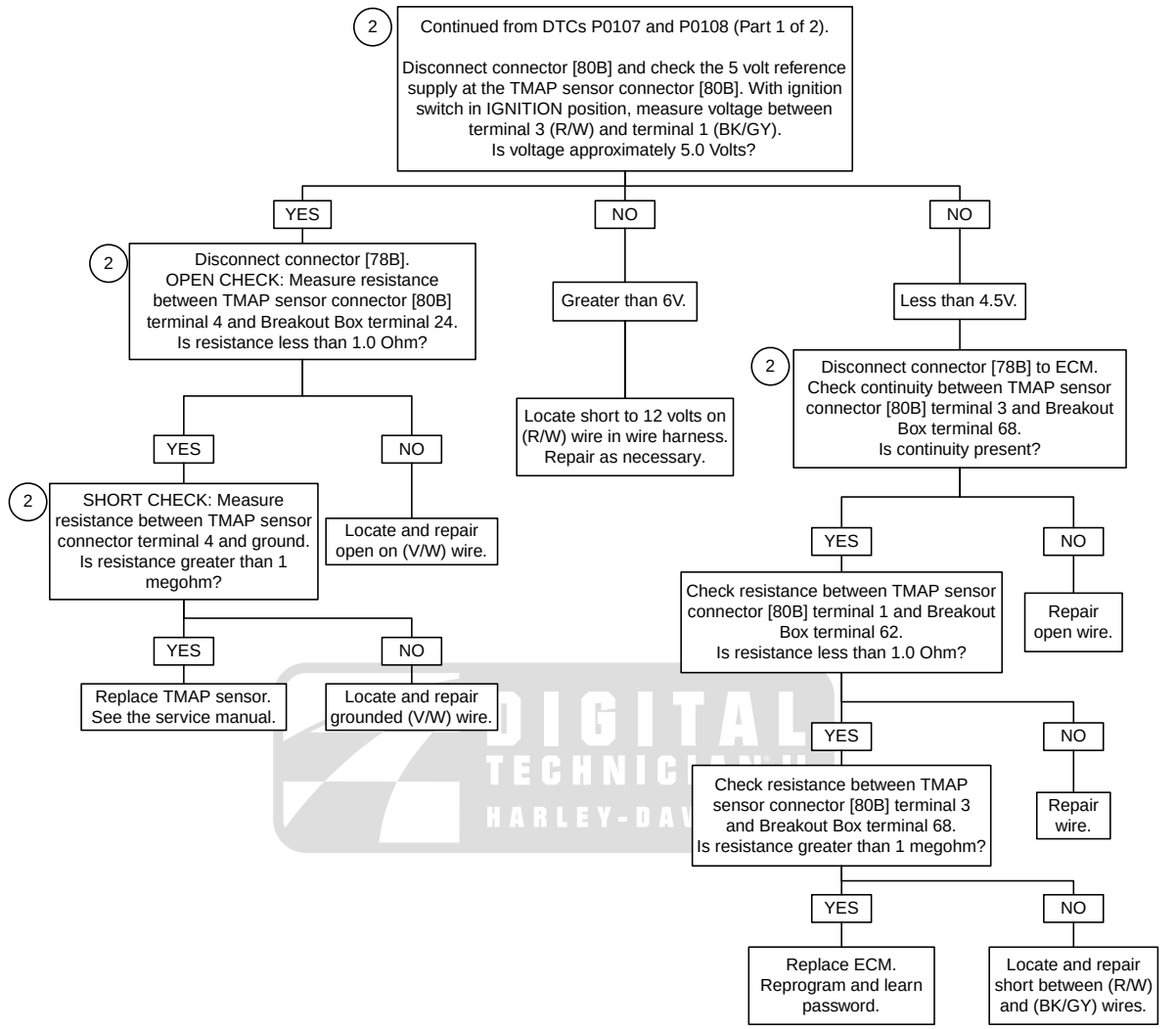
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DTCs P0107 and P0108 (Part 1 of 2)



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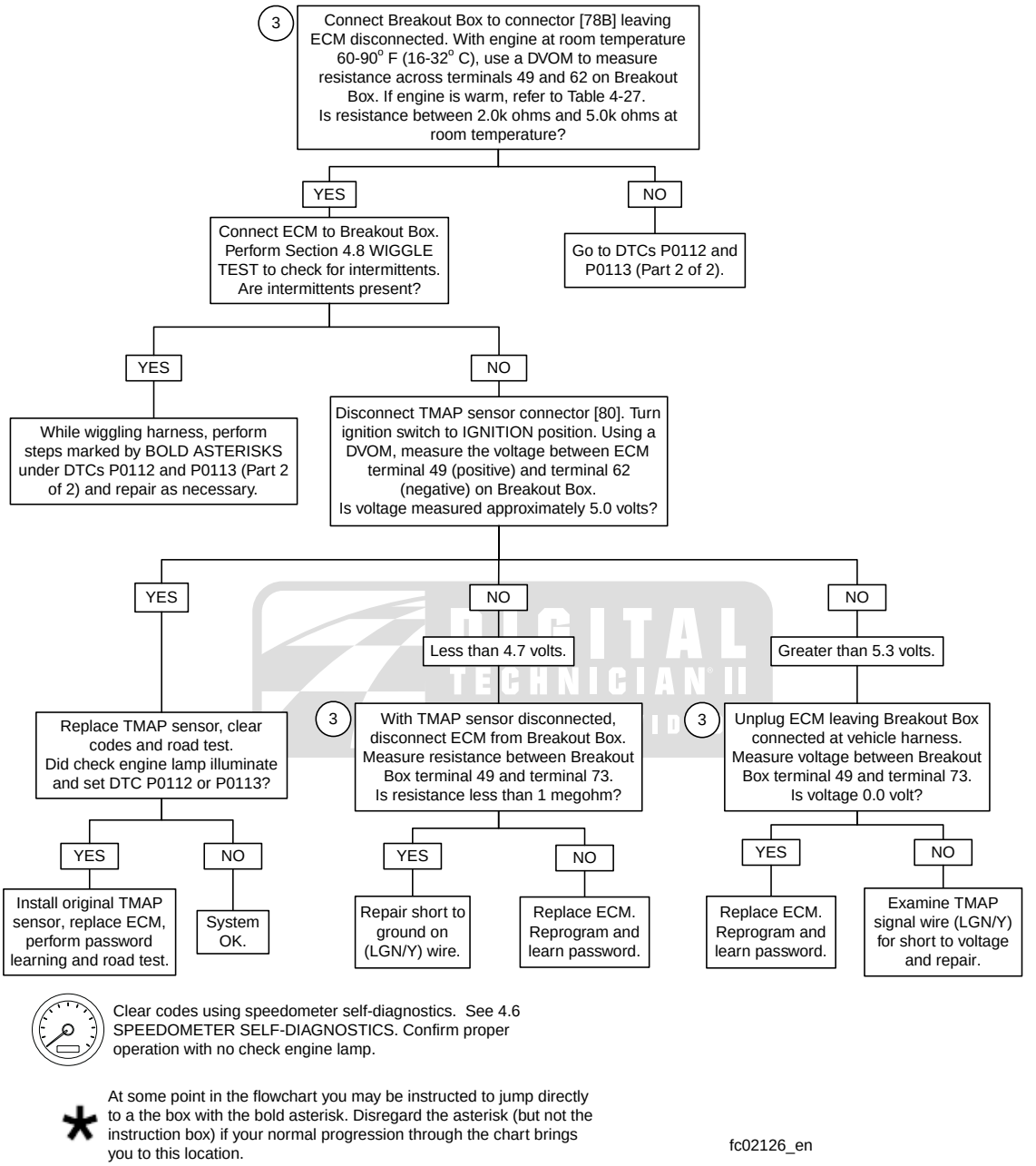
DTCs P0107 and P0108 (Part 2 of 2)



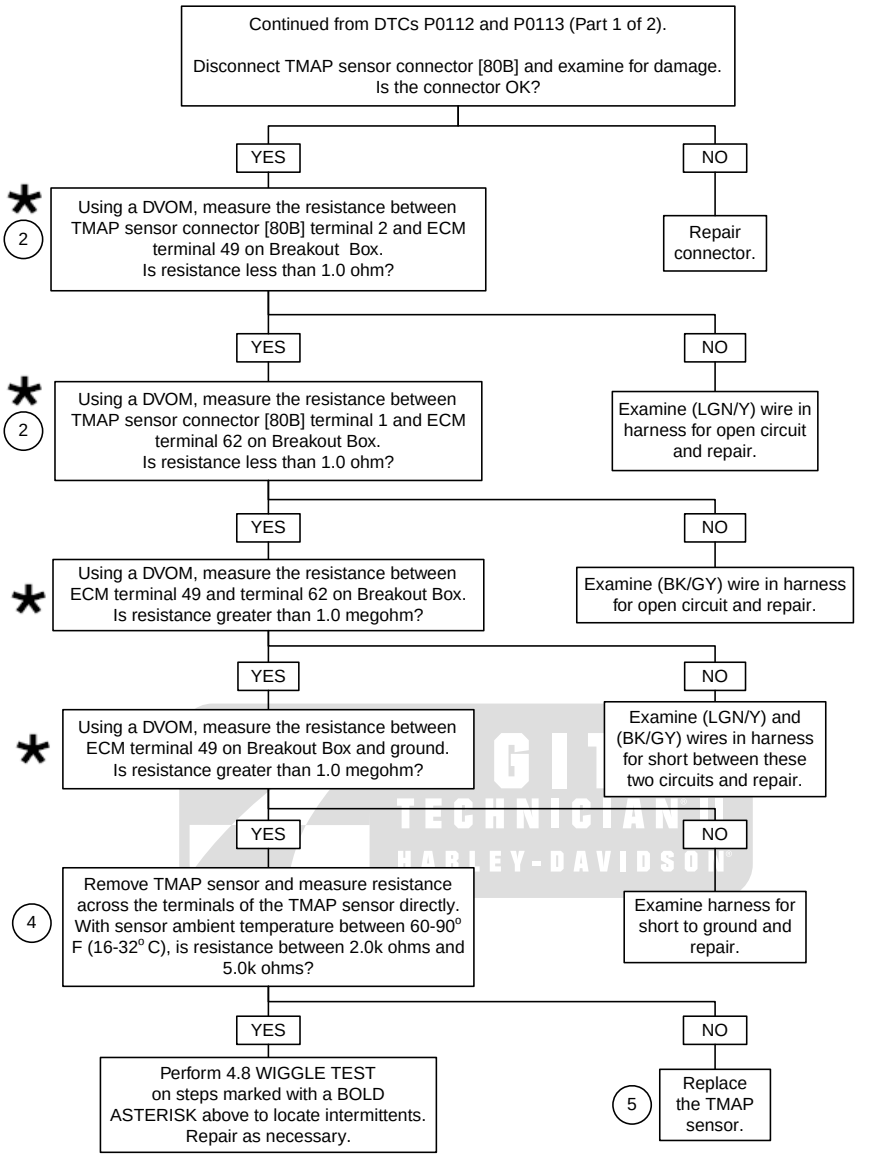
Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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DTCs P0112 and P0113 (Part 1 of 2)



DTCs P0112 and P0113 (Part 2 of 2)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

* At some point in the flowchart you may be instructed to jump directly to a the box with the bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

fc02127_en

DTC P0117, P0118 4.17

GENERAL

ET Sensor

The ECM supplies and monitors a voltage signal to terminal 51 to one side of the ET sensor. The other side of the ET sensor is connected to a common sensor ground. The sensor ground is controlled through the ECM at terminal 61.

The ET sensor is a thermistor device, which means that at a specific temperature it will have a specific resistance across its terminals. As this resistance varies, so does the voltage terminal 51.

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on terminal 51.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5.0 volts.

The ECM monitors this voltage to compensate for various operating conditions.

Table 4-29. Code Description

DTC	DESCRIPTION
P0117	ET sensor voltage low
P0118	ET sensor open/high

Table 4-30. ET Sensor Table

DEG °C	OHMS	COLD V	HOT V	DEG °F
-20	28144	4.4		-4
-10	15873	4.0		14
0	9255	3.5		32
10	5571	2.9		50
20	3457	2.3		68
25	2750	2.0		77
30	2205	1.8		86
40	1442	1.3	4.2	104
50	965	1.0	3.9	122
60	661		3.6	140
70	462		3.2	158
80	329		2.8	176
90	238		2.4	194
100	175		2.0	212

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Tips

- Once the engine is started, the ET voltage should rise steadily.
- An intermittent may be caused by a poor connection, rubbed through wire insulation or an inoperative wire inside the insulation.

Check the following conditions:

- **Poor connection**: Inspect ECM and harness connector [78] for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Perform** 4.8 WIGGLE TEST **to locate intermittents**: If connections and harness check out OK, use a DVOM to check the ET sensor voltage reading while moving related connectors and wiring harness. If the failure is induced, the ET sensor voltage reading will change.
- **Shifted sensor**: Refer to Table 4-30. This table may be used to test the ET sensor at various temperature levels in order to evaluate the possibility of a shifted (out-of-calibration) sensor which may result in driveability problems.

NOTE

All voltage and resistance values are approximate (± 20%). Measure ET sensor resistance between ECM terminal 51 and system ground ECM terminal 61.

Diagnostic Notes: ET Sensor

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) to EFI wire harness only (leave ECM disconnected). See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes and patch cords.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray socket probes and patch cords.
4. Replace ET sensor. See the service manual.

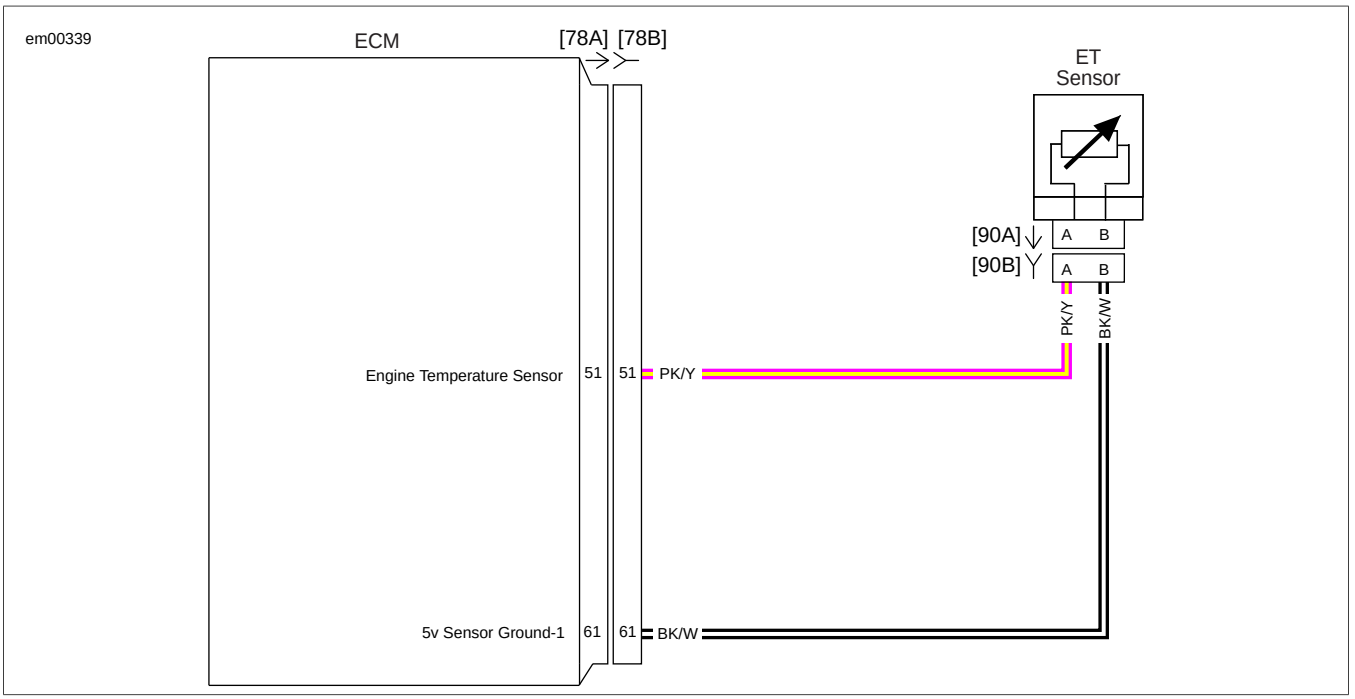
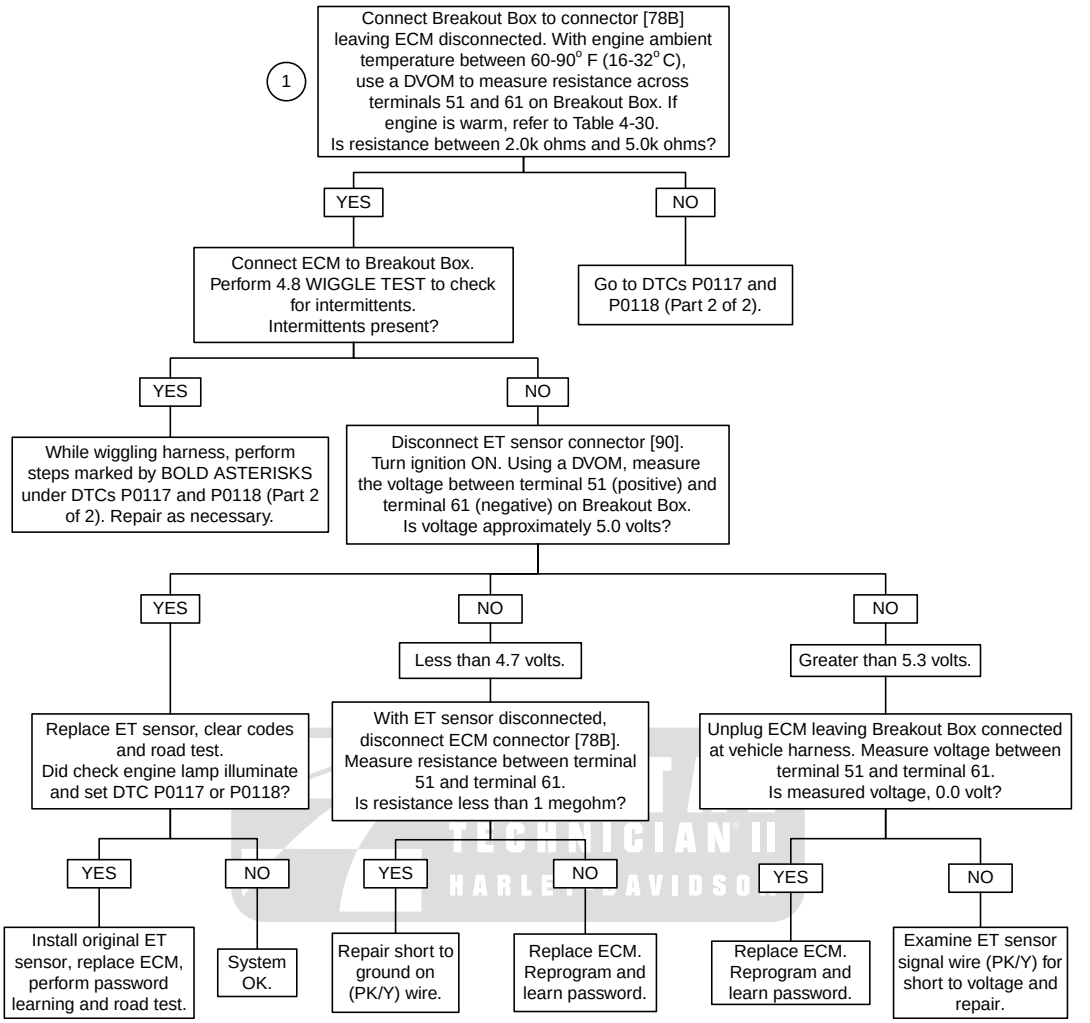


Figure 4-37. ET Sensor Circuit

Table 4-31. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	73-place Delphi	Under seat
[90]	ET sensor	2-place Delphi	Back of front cylinder (left side)

DTCs P0117 and P0118 (Part 1 of 2)

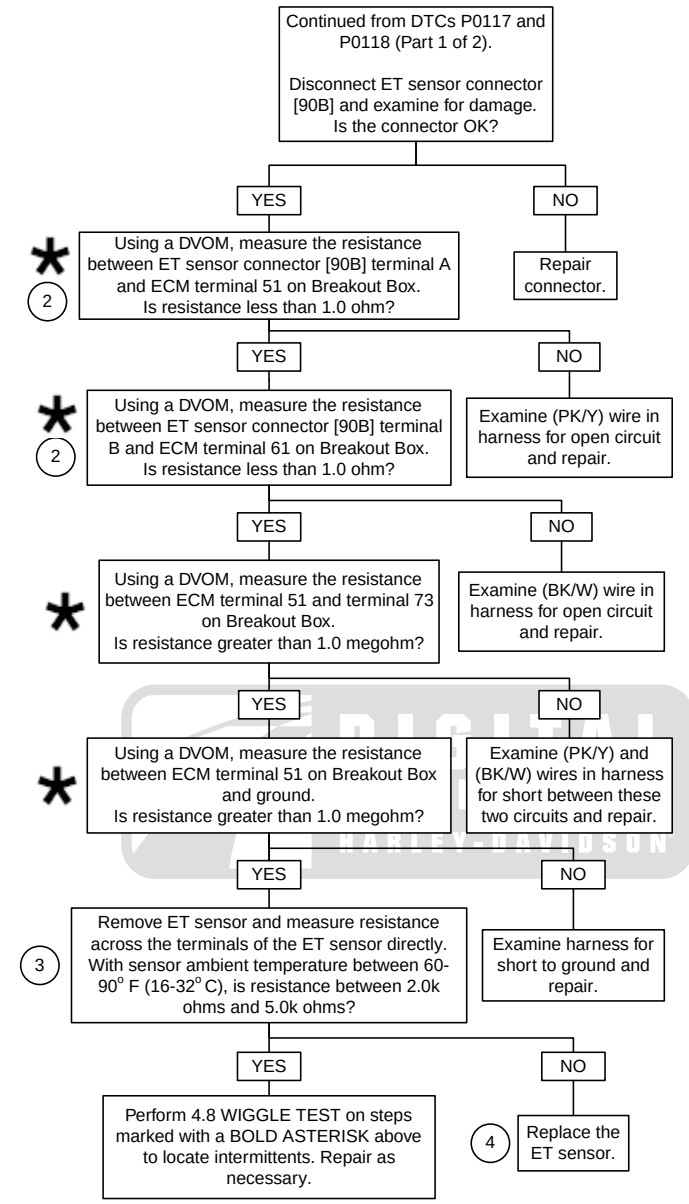


Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

At some point in the flowchart you may be instructed to jump directly to a the box with the bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

fc02128_en

DTCs P0117 and P0118 (Part 2 of 2)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

At some point in the flowchart you may be instructed to jump directly to a the box with the bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

fc02129_en

DTC P0120, P0122, P0123, P0220, P0222, P0223 4.18

GENERAL

See Figure 4-38. A dual TPS is integrated into the TCA, mounted to the induction module.

Within the TCA, a set of potentiometers are designated as TPS (TPS1 and TPS2). The ECM drives the motor in the TCA to open and close the throttle plate based on the signals from the twist grip sensor. The TPS (TPS1 and TPS2) send signals back to the ECM based on throttle plate position to verify the throttle plate movement.

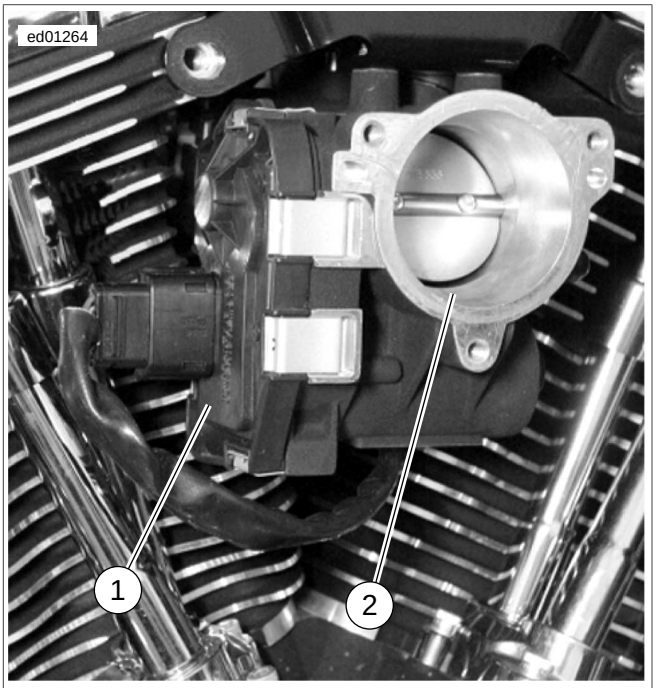
The ECM supplies a 5.0 volt signal from terminal 50 of connector [78] to TPS1 and TPS2. The signals from TPS1 and TPS2 are sent back to the ECM connector [78] terminals 37 and 36 vary in voltage according to actual throttle plate position.

The two TP sensors work opposite each other. When one sensor reads high, the other reads low. The sum of TPS1 and TPS2 signals should measure around 5.0 volts.

Refer to Table 4-32 for defect codes associated with TPS1 and TPS2 of the TCA. See Figure 4-39 for TCA (TPS1 and TPS2) circuitry diagram.

Table 4-32. Code Description

DTC	DESCRIPTION
P0120	TPS1 range error
P0122	TPS1 low/open
P0123	TPS1 high
P0220	TPS2 range error
P0222	TPS2 low/open
P0223	TPS2 high



1. **TCA**
2. **Induction module**

Figure 4-38. Throttle Control Actuator (TCA) Location

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Tips

Check the following conditions:

- **Poor connection**: Inspect ECM and harness connector [78] for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Perform** 4.8 WIGGLE TEST **to locate intermittents**: If connections and harness check out OK, use a DVOM to check the TPS voltage reading while moving related connectors and wiring harnesses. If the failure is induced, then TPS voltage will change.
- An intermittent may be caused by poor connection, rubbed through wire insulation or an inoperative wire within the wire insulation.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

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2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes, socket probes and patch cords.

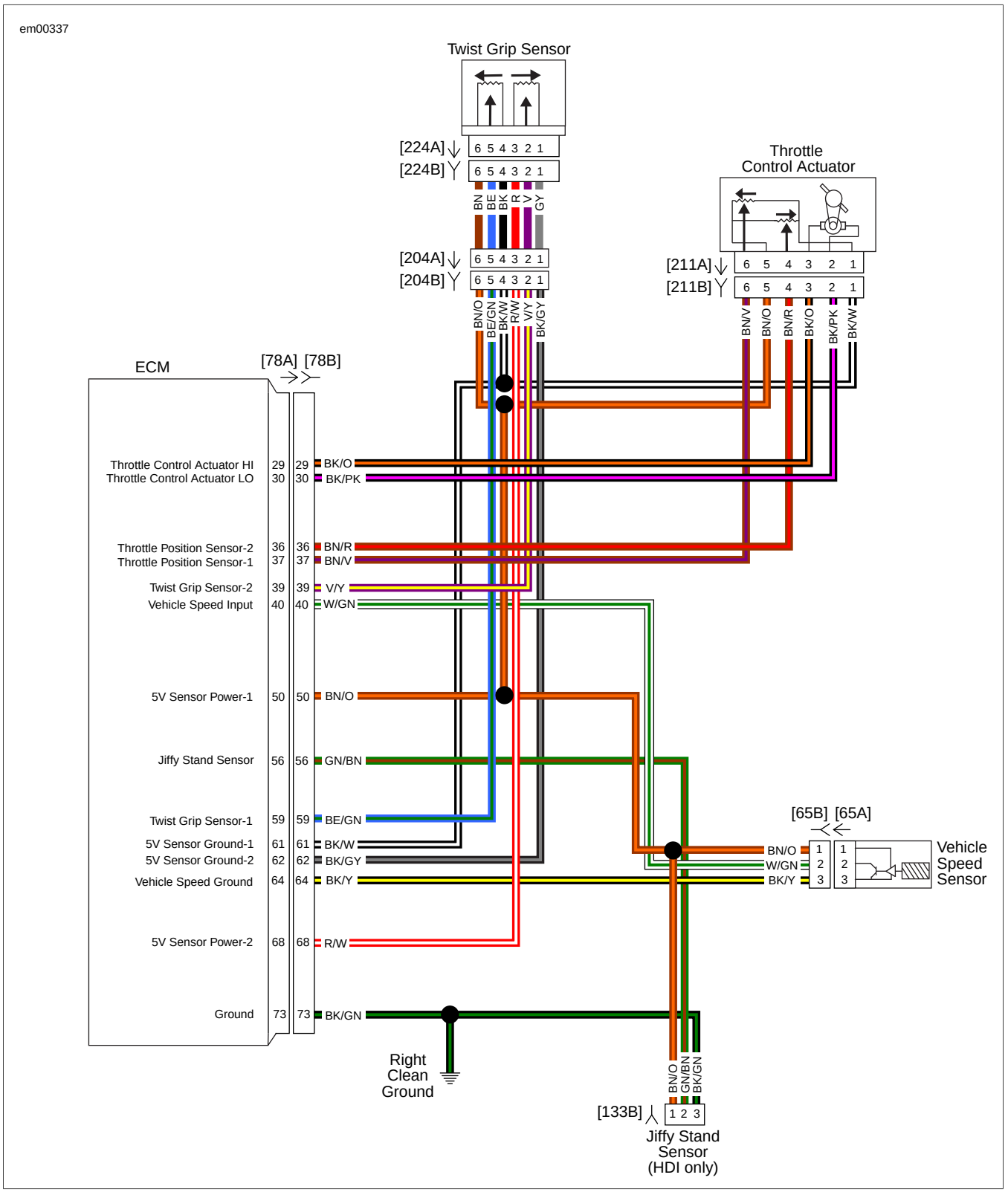


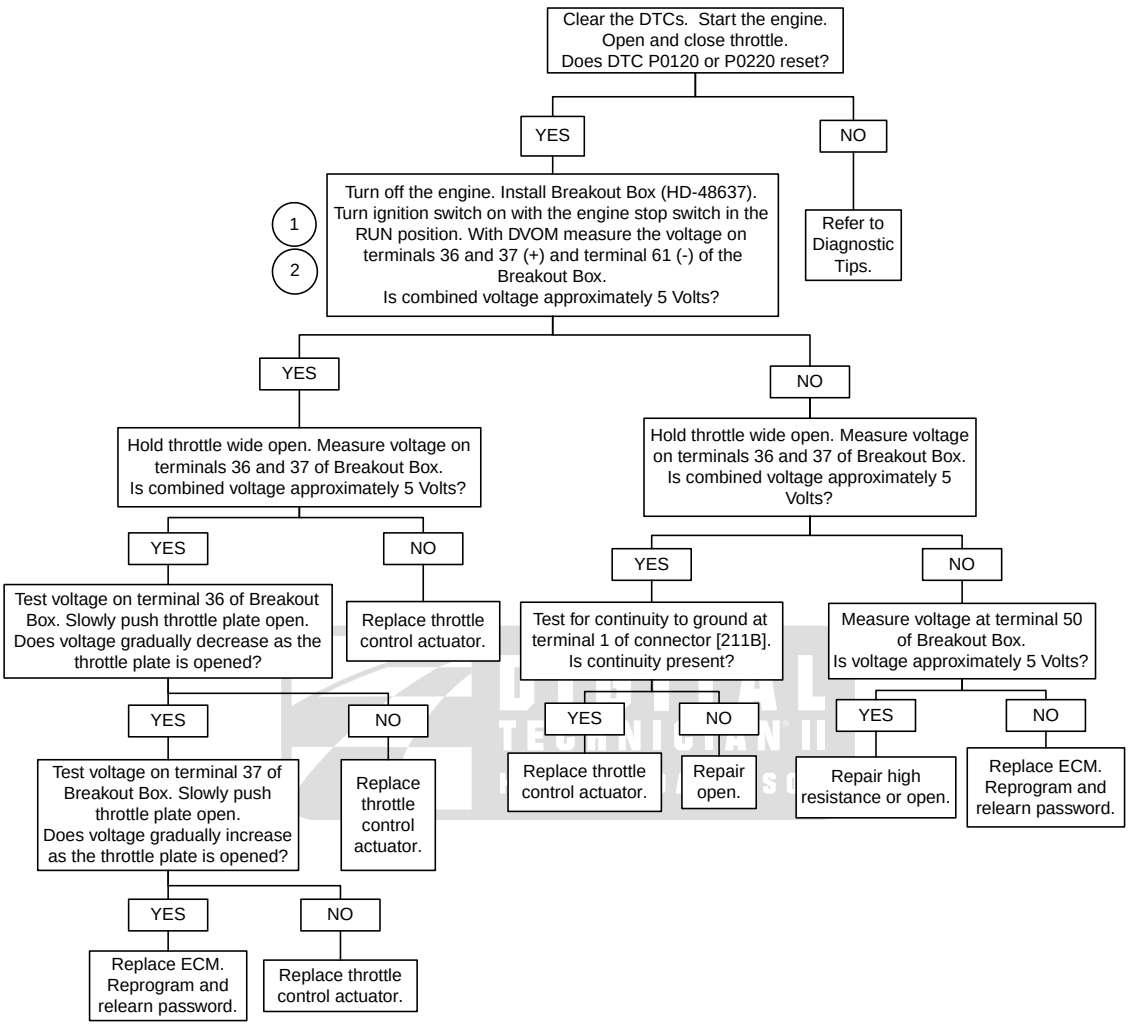
Figure 4-39. TCA Circuit

Table 4-33. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[65]	VSS	All	3-place Delphi	Top of transmission case (under starter)
[78]	ECM	All	73-place Delphi	Under seat
[133]	Jiffy stand sensor	All	3-place Molex (black)	Domestic (not used) HDI: Rear of lower front frame cross-member
[204]	TGS harness	FLHT/C/U/X	6-place Molex (black)	Inner fairing - right radio support bracket
		FLTR	6-place Molex (black)	Inner fairing - right side below radio
		FLHR	6-place Molex (black)	Inside headlamp nacelle, fork stem nut lock plate
[211]	TCA	All	6-place Molex	Right side of engine (induction module)
[224]	TGS	All	7-place Amp (Tyco)	Handlebar throttle (inside right side of handlebar)

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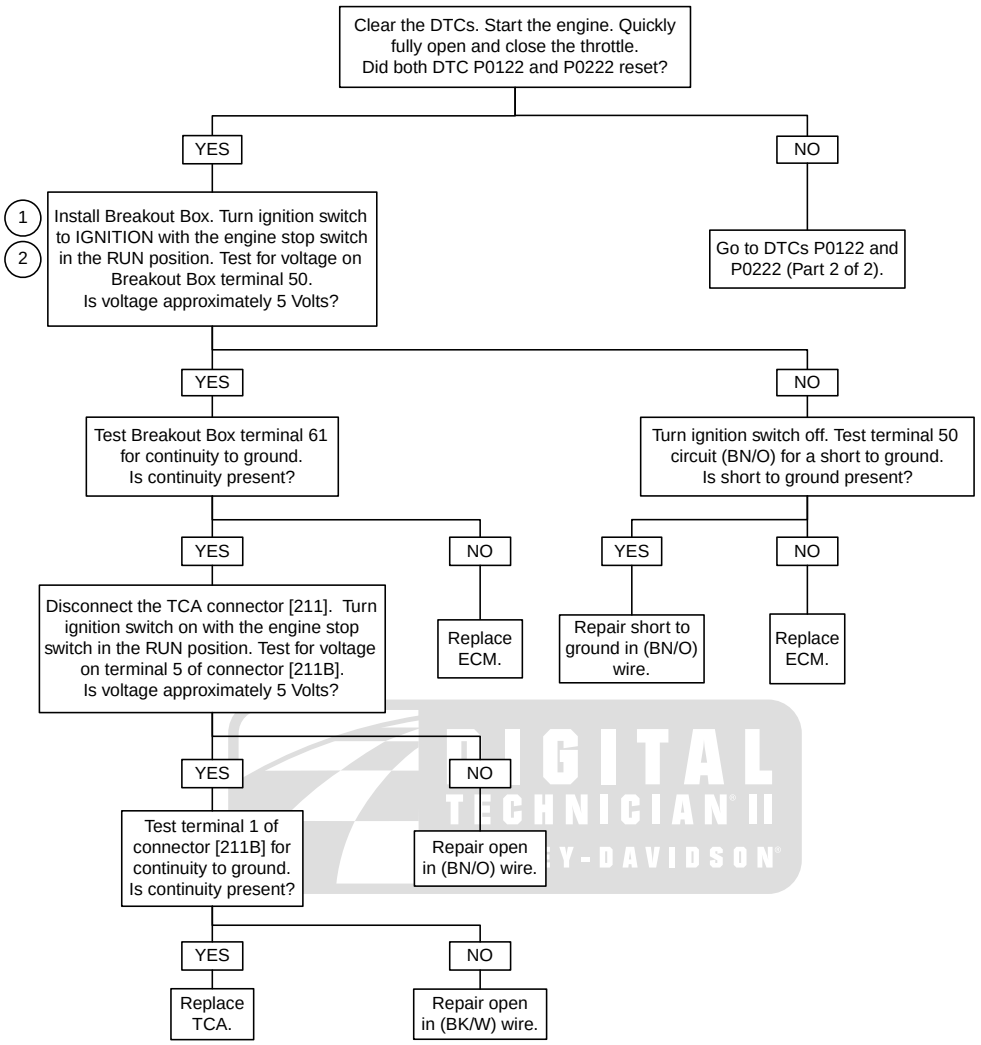
DTCs P0120 and P0220



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

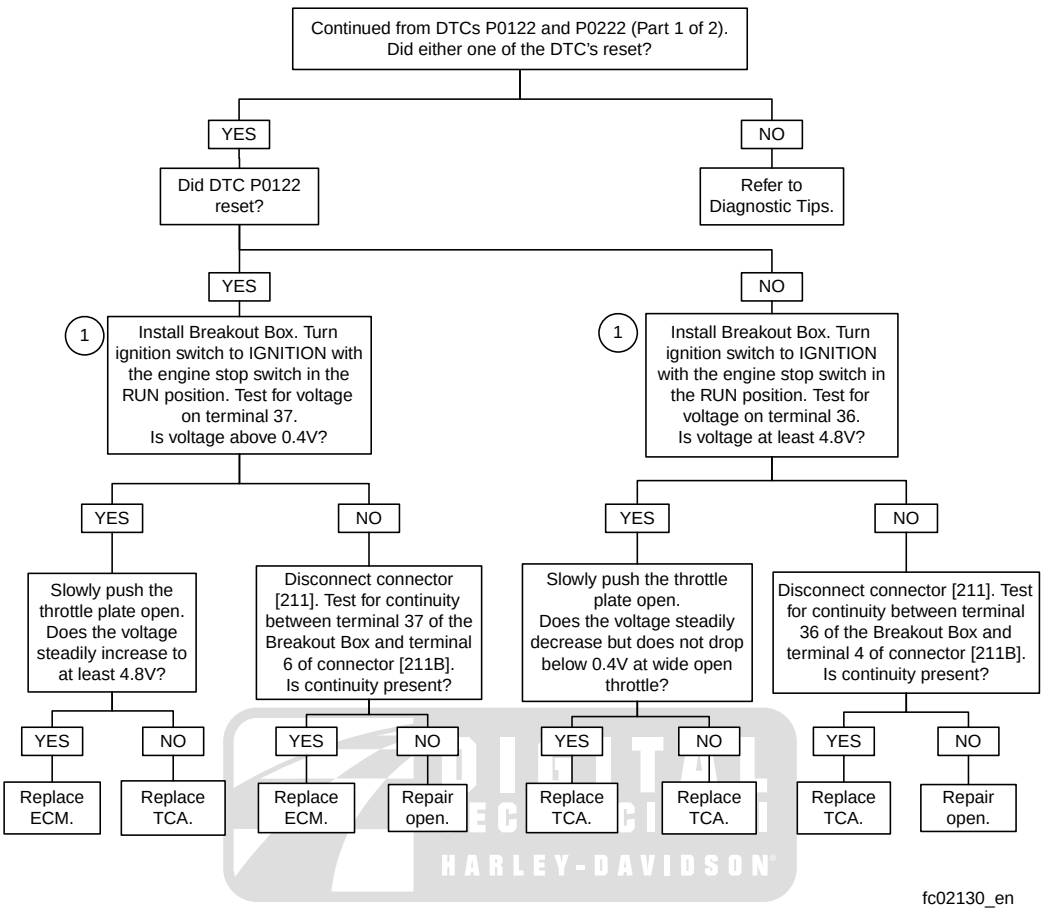
fc02203_en

DTCs P0122 and P0222 (Part 1 of 2)

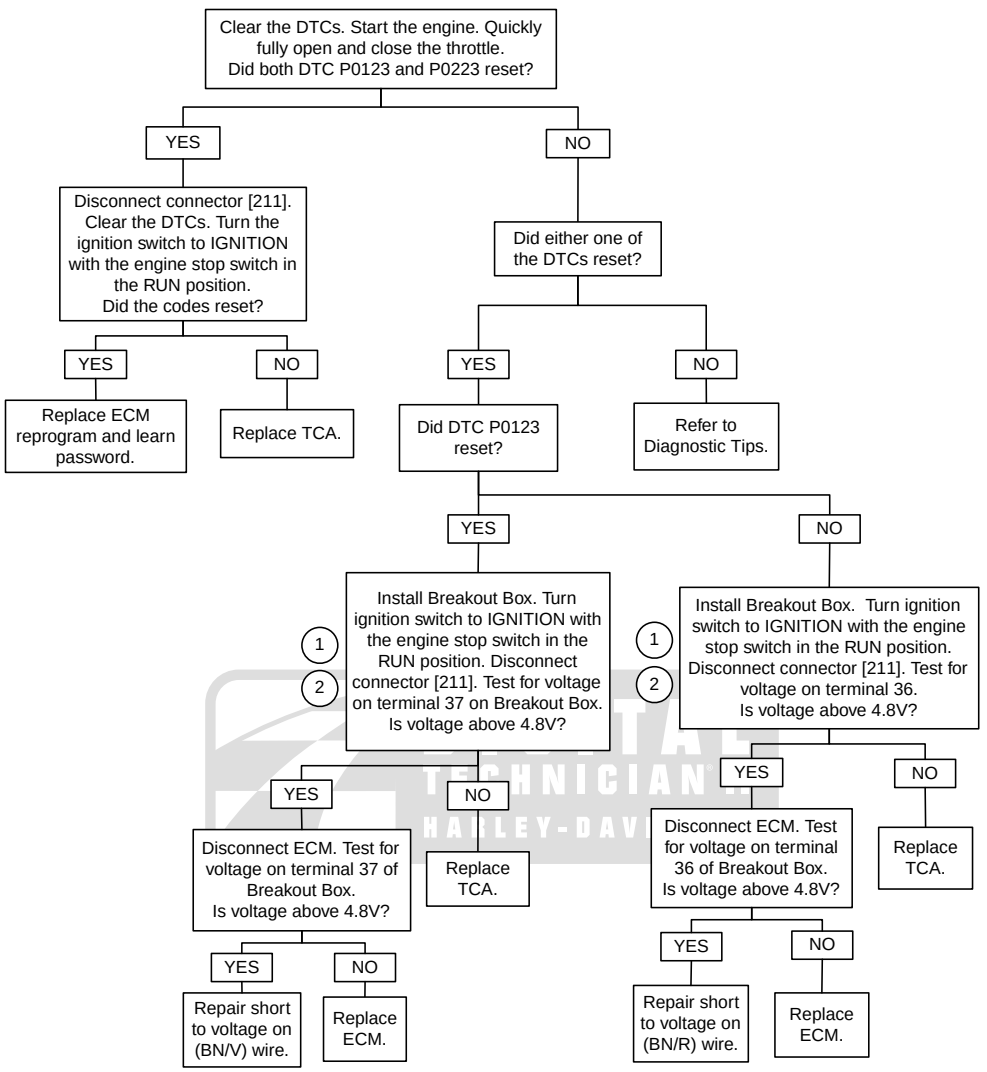


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DTCs P0122 and P0222 (Part 2 of 2)



DTCs P0123 and P0223



fc02131_en

DTC P0131, P0132, P0134, P0151, P0152, P0154 4.19

GENERAL

Oxygen Sensor

See Figure 4-40. The O2 sensor provides a signal to the ECM which indicates whether the engine is running rich or lean.

- DTC P0131 (front) or P0151 (rear) is set when the ECM detects an excessively lean condition for a specified length of time. DTCs may also set if O2 sensor fails.
- DTC P0132 (front) or P0152 (rear) is set when the ECM detects an excessively rich condition for a specified length of time. DTCs may also set if O2 sensor fails.
- DTC P0134 is set when the front O2 sensor circuit is open or sensor is too cold to respond. A DTC P0154 is set when the rear O2 sensor circuit is open or sensor is too cold to respond.

When the air/fuel mixture is ideal, approximately 14.6 parts air to 1 part fuel, the voltage measured at the sensor terminals will average 0.45V. Note that the sensor return is elevated 0.75V above vehicle ground.

Table 4-34. Code Description

DTC	DESCRIPTION
P0131	Front O2 sensor low or engine running lean
P0132	Engine running rich
P0134	Front O2 sensor open/not responding/high
P0151	Rear O2 sensor low or engine running lean
P0152	Engine running rich
P0154	Rear O2 sensor open/not responding/high

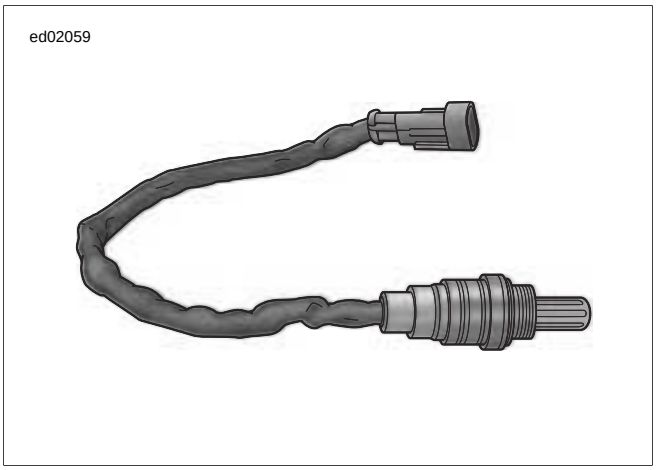


Figure 4-40. Oxygen Sensor

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-48637	BREAKOUT BOX
HD-48650	DIGITAL TECHNICIAN II

Diagnostic Tips

DTCs for the O2 sensor may be seen during the vehicle break-in period. The O2 sensor diagnostic codes will not illuminate the check engine lamp for current or historic codes and will only be indicated by DIGITAL TECHNICIAN II (Part No. HD-48650) or speedometer self-diagnostics. If the diagnostic codes are reported during the break-in period, clear or ignore the codes until the break-in period is completed. All historic O2 sensor diagnostic codes are to be ignored and cleared.

The DVOM displays the signal from the O2 sensor in volts. This voltage will have an average value tending towards lean, rich or ideal value depending on operating temperature of the engine, engine speed and throttle position. An open/short to voltage or short to ground in the (PK/O) wire (front) and (PK/GN) wire (rear) will cause the engine to run rich (short to ground) or lean (short to voltage) until fault is detected. Once fault is detected, vehicle will run in open loop.

Check for the following conditions:

- **Poor connection**: Inspect the ECM harness connector [78], fuel injector connectors [84, 85] and O2 sensor connector wiring for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harnesses.
- **Dirty/stuck open injectors**: The motorcycle may run lean (dirty/clogged injectors) or rich (stuck open injectors) if there are injector problems. This could also cause poor fuel economy and performance.
- **Loose oxygen sensor**: If the O2 sensor is loose, engine performance may be affected. This could also show up as a slow changing O2 sensor voltage.
- **Loose/leaking exhaust**: This can cause a poor ground connection for the sensor or allow fresh air into the exhaust system. If fresh air enters exhaust system, the O2 sensor will read a lean condition, causing the system to go rich.
- **Engine misfire**: See 4.14 MISFIRE AT IDLE OR UNDER LOAD.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect a BREAKOUT BOX (Part No. HD-48637) between EFI wire harness and ECM before measuring voltage. See 4.7 BREAKOUT BOX: EFI.
2. 4.25 Volts is typical for a cold engine. Once the O2 sensors are up to operating temperature, typical voltage is 0-0.9 Volts.
3. See Intake Leak Test in the service manual.

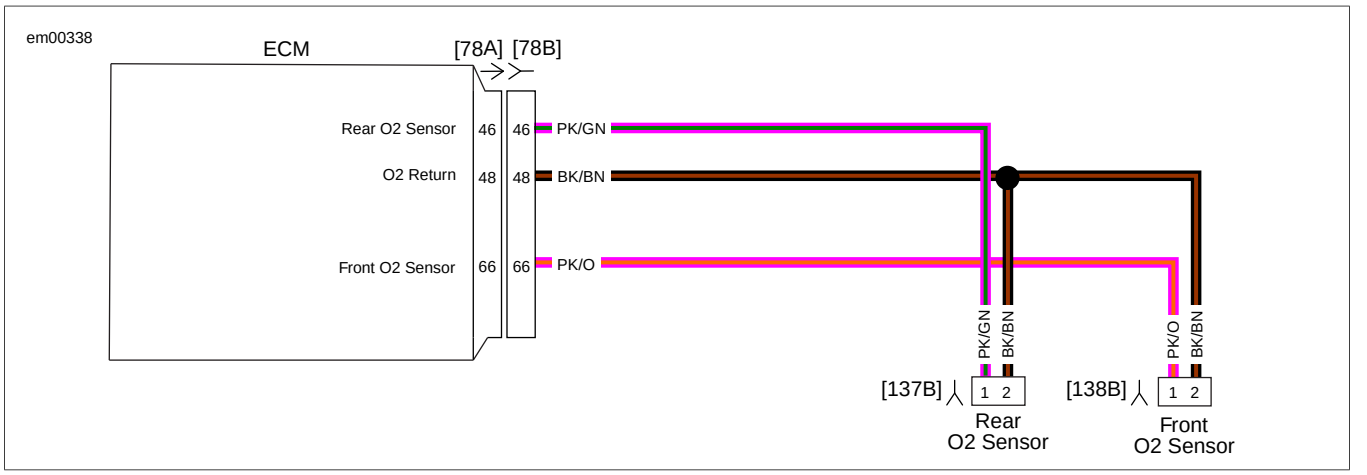


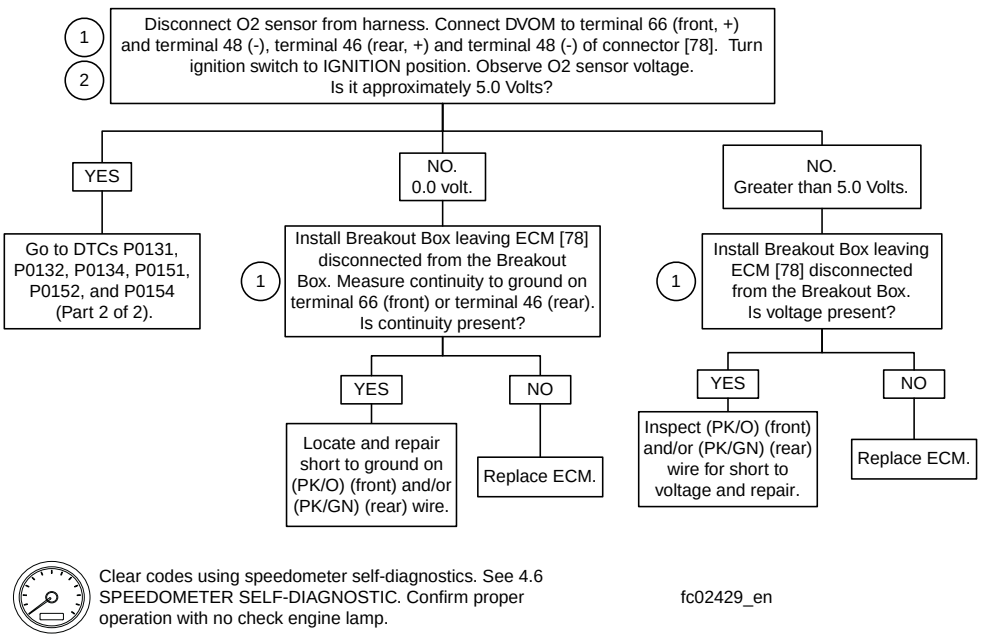
Figure 4-41. Oxygen Sensor Circuit Diagram

Table 4-35. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	73-place Delphi	Under seat
[137]	O2 sensor rear exhaust header	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	2-place Amp (Tyco)	Back of cross brace between front frame downtubes

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DTCs P0131, P0132, P0134, P0151, P0152, and P0154 (Part 1 of 2)

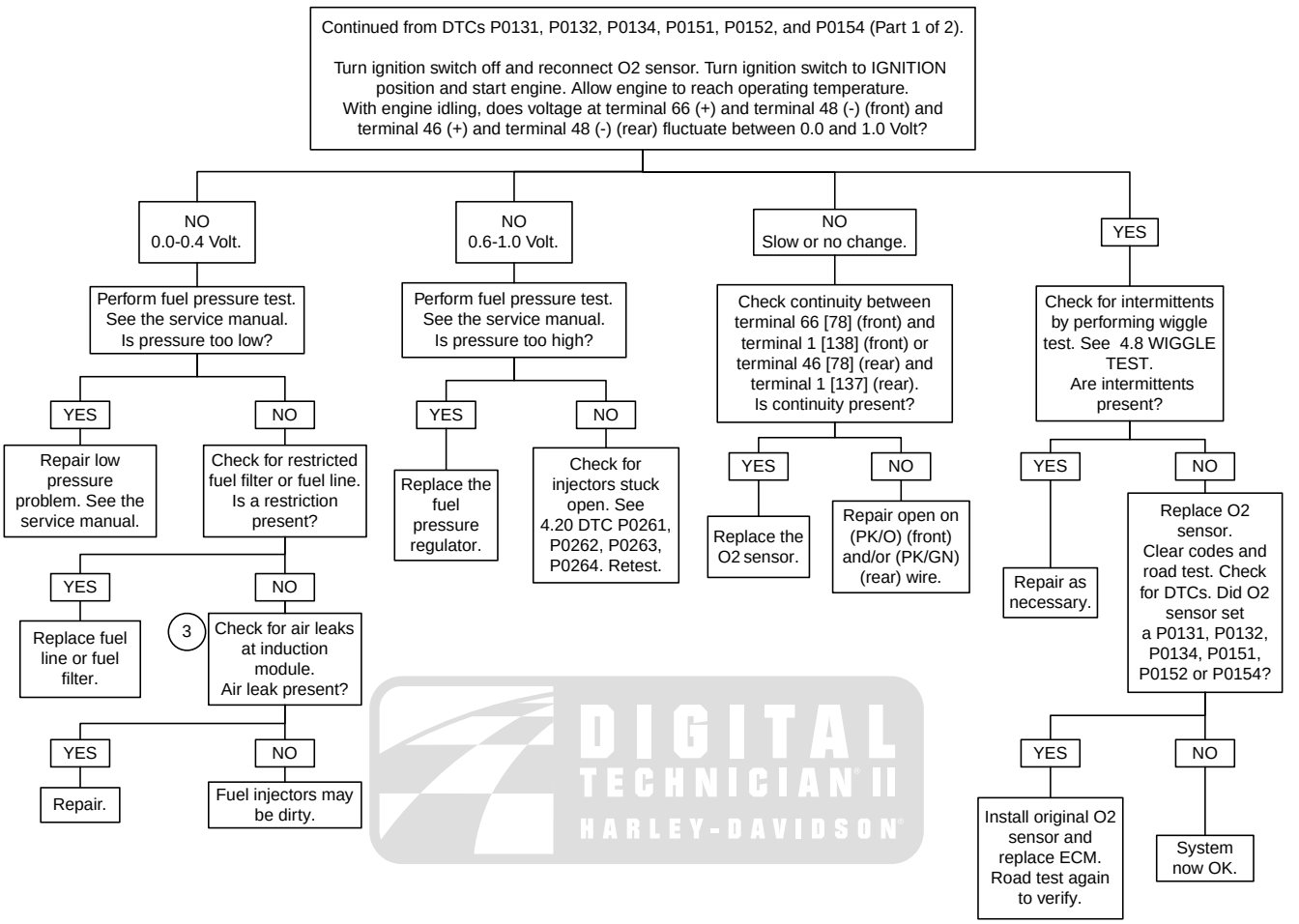


Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTCs P0131, P0132, P0134, P0151, P0152, and P0154 (Part 2 of 2)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTC P0261, P0262, P0263, P0264 4.20

GENERAL

Fuel Injectors

The fuel injectors are solenoids that allow pressurized fuel into the intake tract. The injectors are timed to the engine cycle and triggered sequentially. The power for the injectors comes from the system relay. The system relay also provides power for the fuel pump and the ignition coil. The ECM provides the path to ground to trigger the fuel injectors.

NOTE

ECM fuse and system relay failures or wiring harness problems will cause 12 volt power to be lost to both fuel injectors, ignition coils and fuel pump.

Table 4-36. Code Description

DTC	DESCRIPTION
P0261	Front injector open/low
P0262	Front injector high
P0263	Rear injector open/low
P0264	Rear injector high

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-34730-2C	FUEL INJECTOR TEST LAMP
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. See the service manual for all service information.
2. Use FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C). See Figure 4-42.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord.
4. Connect a BREAKOUT BOX (Part No. HD-48637) between EFI wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

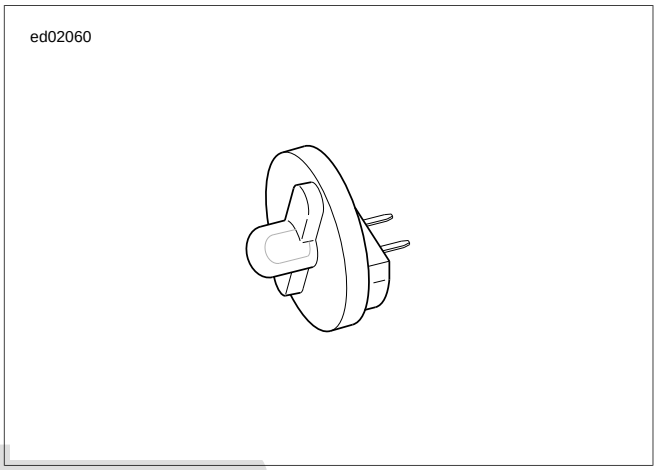


Figure 4-42. Fuel Injector Test Lamp (Part No. HD-34730-2C)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

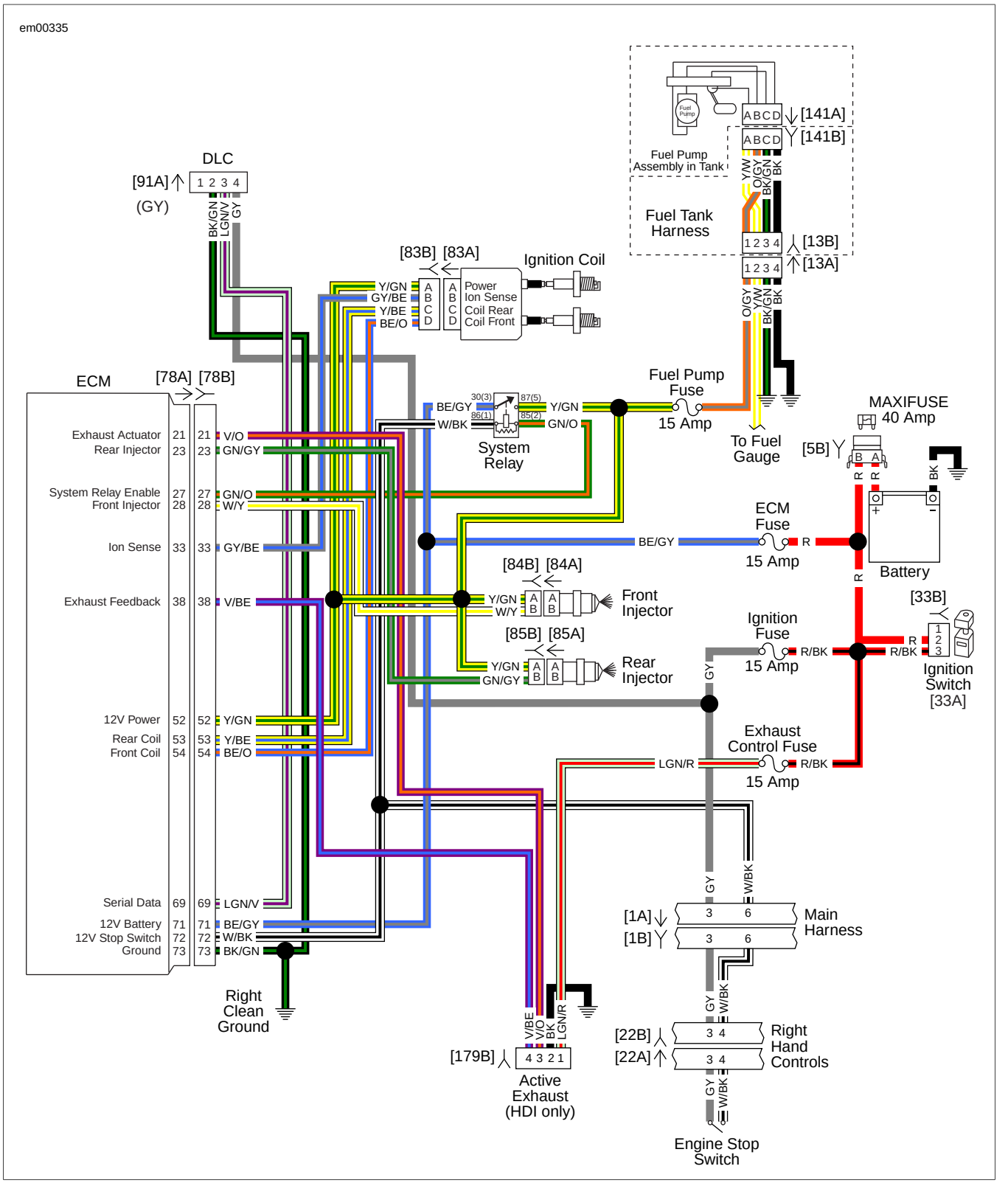


Figure 4-43. Fuel Injector Circuit (FLHX, FLHT/C/U, FLTR)

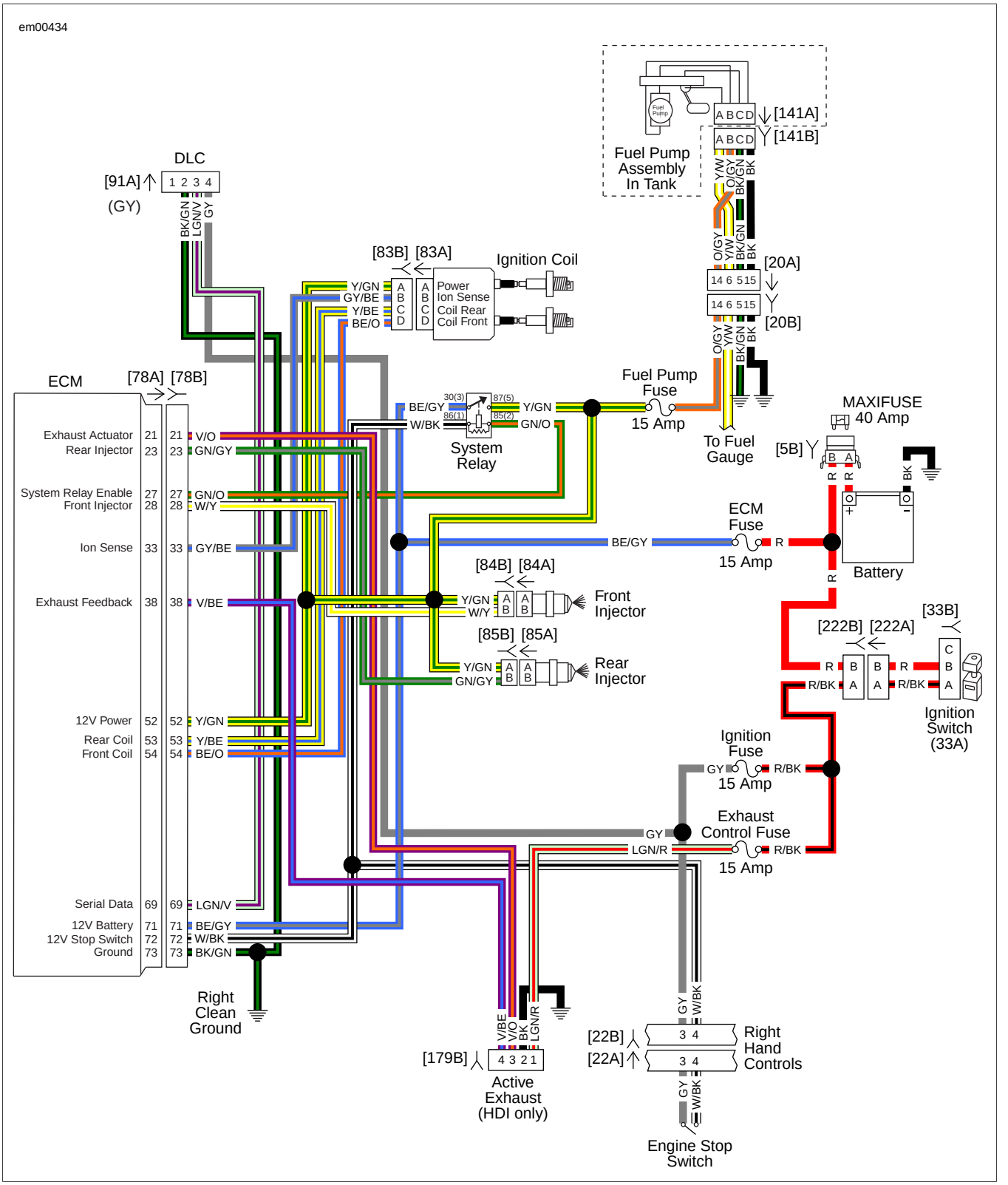


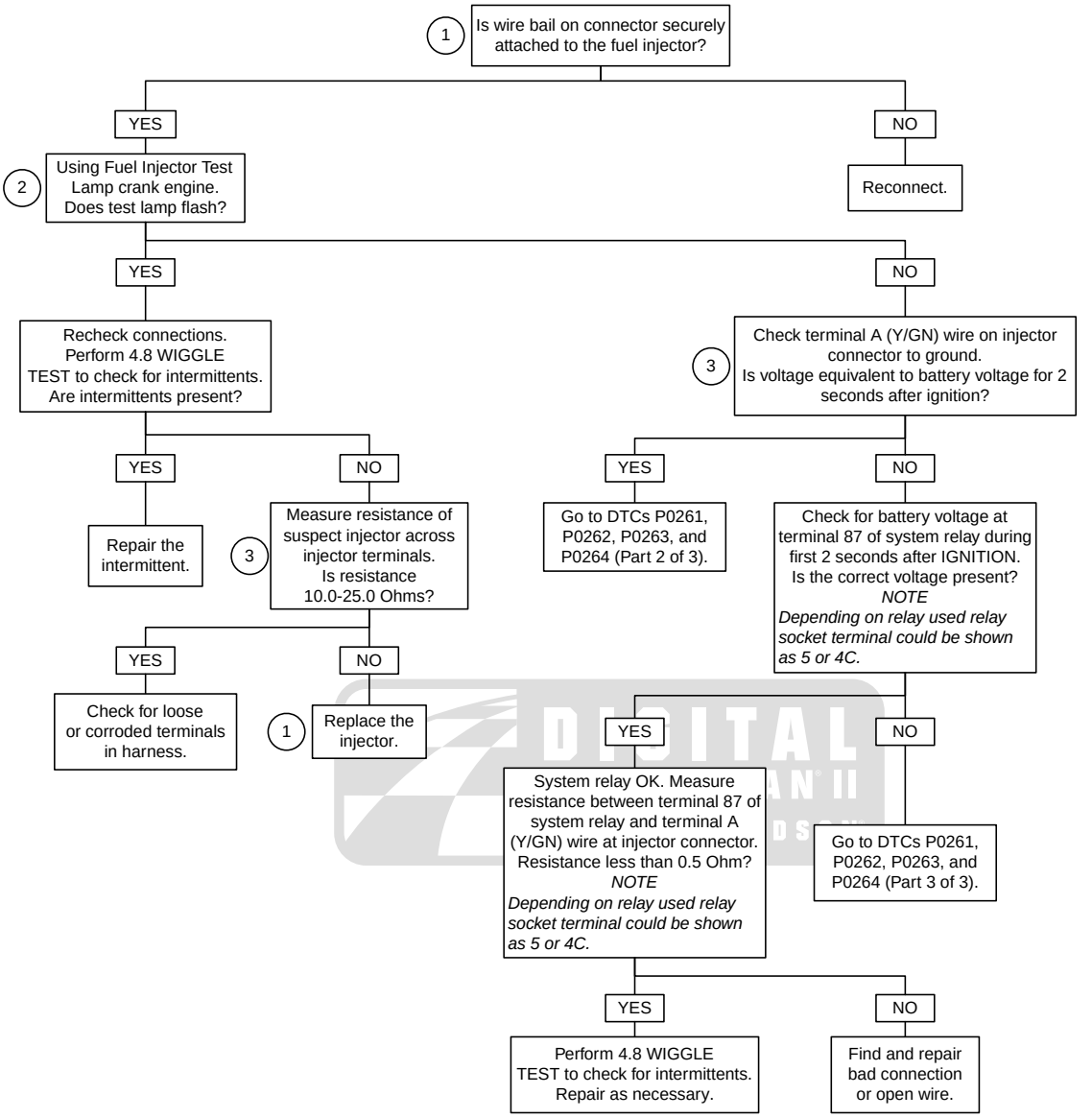
Figure 4-44. Fuel Injector Circuit (FLHR/C)

Table 4-37. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side below radio
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[13]	Fuel tank harness	All	4-place Multilock	Behind fuel tank (under seat)
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[22]	Right handlebar switches	FLHR/C	6-place Molex (Black)	Inside headlamp nacelle fork stem nut lock plate (right side)
		FLHT/C/U/X	12-place Molex (Black)	Inner fairing - right fairing support bracket
		FLTR	12-place Molex (Black)	Inner fairing - left fairing support bracket
[33]	Ignition switch	FLHT/C/U FLTR	3-place Packard	Bottom of ignition switch housing
		FLHR/C	3-place Packard	Under console
[78]	ECM	All	73-place Delphi	Under seat
[83]	Ignition coil	All	4-place Delphi	Bottom front of battery tray
[84]	Front injector	All	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	All	2-place Delphi	Below fuel tank (left side)
[91]	DLC	All	4-place Deutsch	Under left side cover
[141]	Fuel pump and fuel level sender	FLHX FLHT/C/U	4-place Packard	Under console on top of fuel tank canopy
		FLHR/C FLTR	4-place Packard	Top of canopy (under console)
[179]	Active exhaust actuator	All	5-place Amp (Tyco)	Domestic (not used)
				HDI: Under right side cover
[222]	Console ignition switch interconnect	FLHR/C	4-place Packard	Under seat

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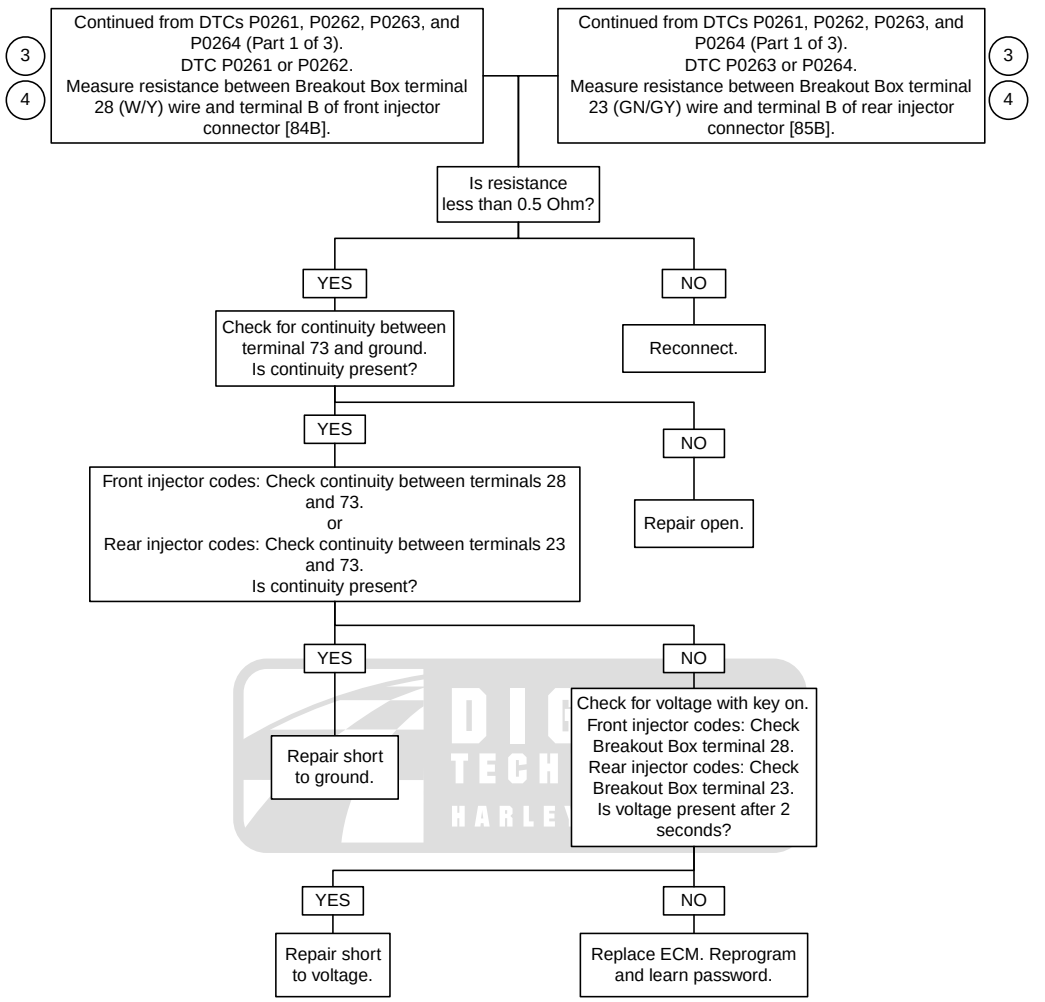
DTCs P0261, P0262, P0263, and P0264 (Part 1 of 3)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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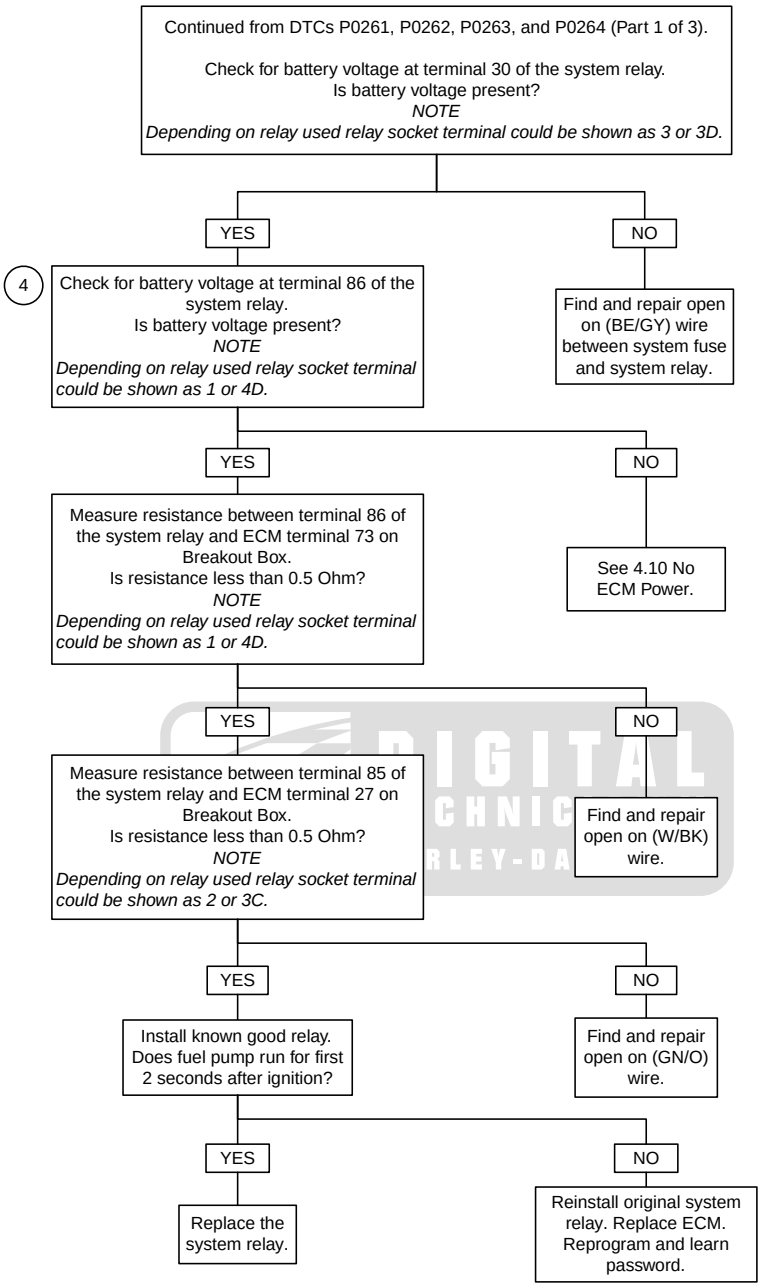
DTCs P0261, P0262, P0263, and P0264 (Part 2 of 3)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTCs P0261, P0262, P0263, and P0264 (Part 3 of 3)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

fc02137_en

DTC P0373, P0374 4.21

GENERAL

CKP Sensor

If the CKP sensor signal is weak or absent, DTC P0373 or P0374 will be set.

NOTE

If signal is not detected or cannot synchronize (DTC P0374), engine will not start.

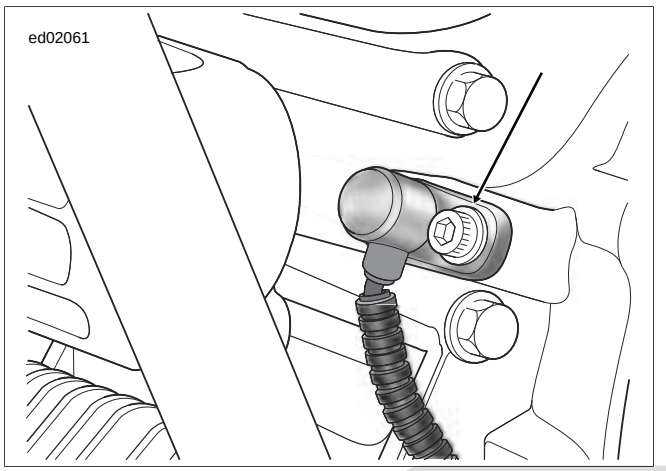
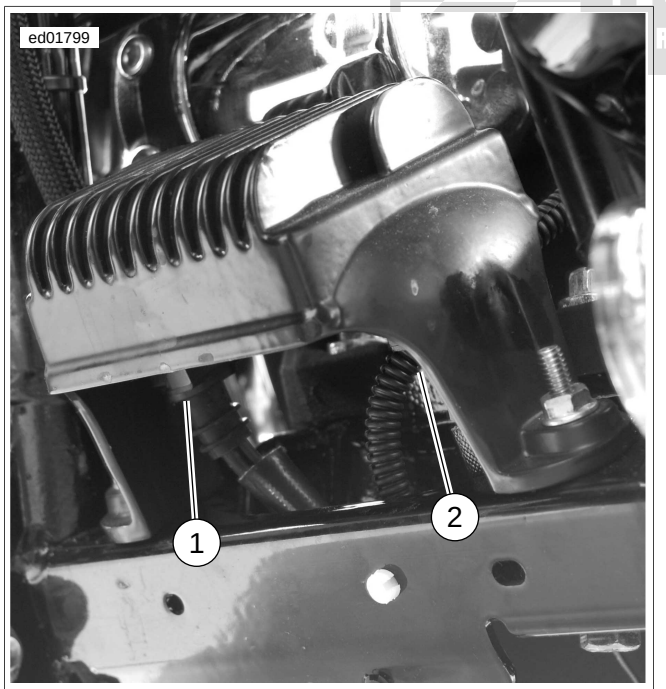


Figure 4-45. CKP Sensor



1. **Voltage regulator [77]**
2. **Stator [47]**

Figure 4-46. Voltage Regulator (Left Side View)

Table 4-38. Code Description

DTC	DESCRIPTION
P0373	CKP sensor intermittent
P0374	CKP sensor synch error

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Tips

Engine must be cranked for more than five seconds without CKP sensor signal to set a DTC.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) to ECM wire harness only (leave ECM disconnected). See 4.7 BREAKOUT BOX: EFI.
2. One megohm is very high resistance. Some meters read OL.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown socket probes and patch cords.
4. For testing purposes, install sensor without running wiring along normal path. Disconnect and route wiring properly if system is now OK.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

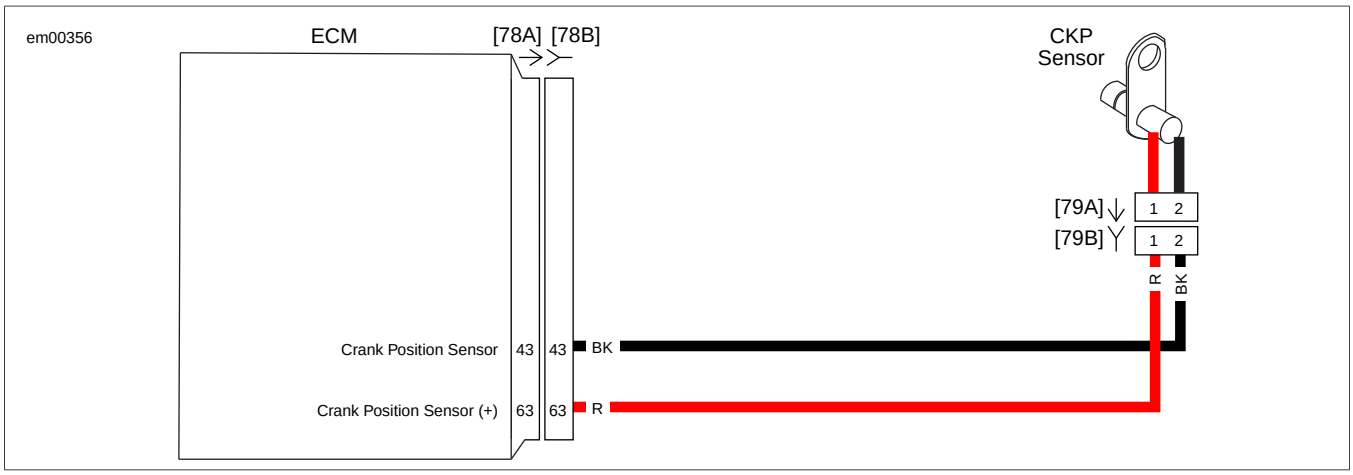


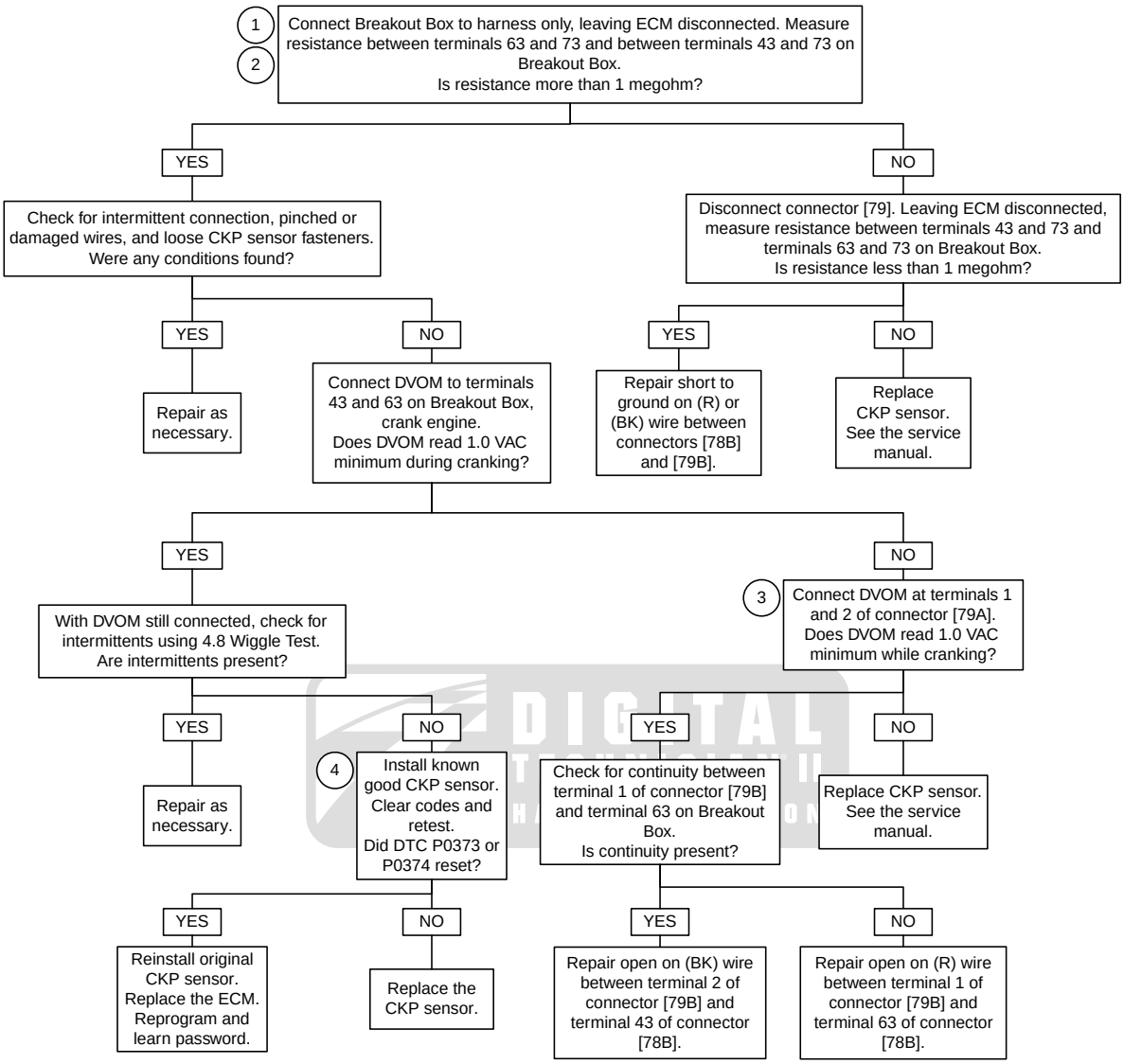
Figure 4-47. CKP Sensor Circuit

Table 4-39. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	73-place Delphi	Under seat
[79]	CKP sensor	2-place Deutsch	Rear of lower front frame crossmember

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTCs P0373 and P0374



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

fc02138_en

DTC P0444, P0445 4.22

GENERAL

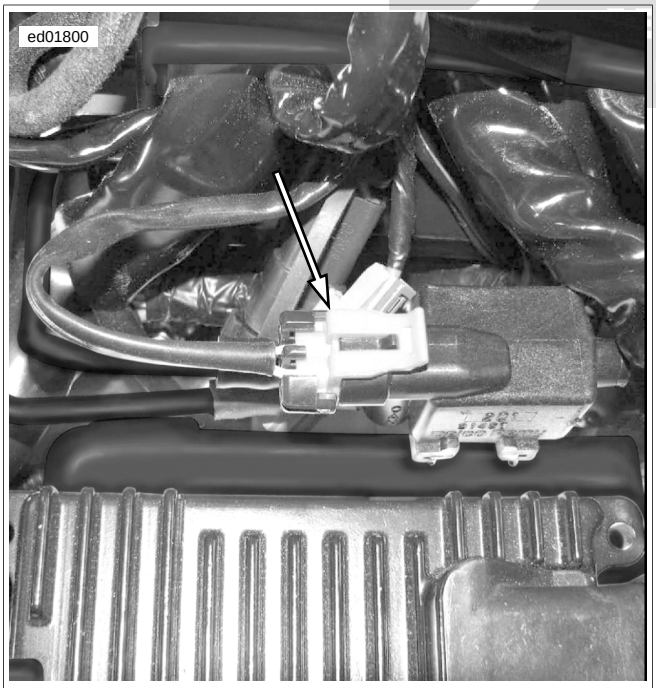
Purge Solenoid (CA and Select Foreign Market Models Only)

See Figure 4-48. To comply with California Emissions, a purge solenoid is mounted beneath the seat of the vehicle, connecting to the vent line in the top of the fuel tank and to a vent canister mounted on the vehicle chassis under the seat in front of the purge solenoid. A return line from the canister reconnects to the air intake manifold allowing vented fumes to be recirculated, for emission efficiency.

The purge solenoid is timed to the throttle position and is disabled during startup, low engine temperature, low engine speed or low vehicle speed. Power for the purge solenoid is supplied by the system relay. The system relay also provides power for the VSS, fuel pump and the ignition coil. The ECM provides a path to ground to trigger the purge solenoid.

NOTES

- *System fuse and system relay failures or wiring harness problems will cause 12V power to be lost to the VSS, ignition coils, fuel pump and purge solenoid.*
- *Purge solenoid is not installed on non-California vehicles and DTCs P0444 and P0445 are not available. If these DTCs appear, the ECM is improperly programmed and should be reprogrammed.*



1. **Purge solenoid**
2. **Charcoal canister**

Figure 4-48. Purge Solenoid Mounting Location

Table 4-40. Code Description

DTC	DESCRIPTION
P0444	Purge solenoid open/low
P0445	Purge solenoid high

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-34730-2C	FUEL INJECTOR TEST LAMP
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Each reference number below correlates to a circled number on the flowchart(s).

Diagnostic Notes

1. See the service manual for all service information.
2. See Figure 4-49. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple terminal probes and patch cord to and gray socket probes and patch cord to FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C).
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple terminal probe and patch cord.
4. See 4.7 BREAKOUT BOX: EFI. Connect a BREAKOUT BOX (Part No. HD-48637) to the ECM and mating connector.
5. See Figure 4-49. Use FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C) to test the purge solenoid circuit by plugging the test lamp into connector [95B].

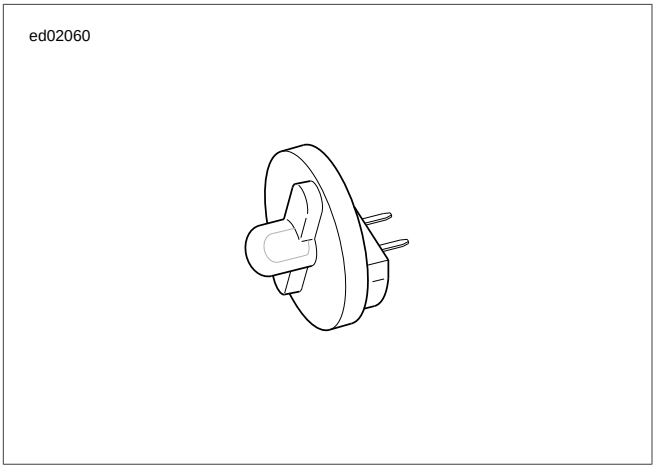


Figure 4-49. Fuel Injector Test Lamp (Part No. HD-34730-2C)

Diagnostic Procedure

NOTE

To access the purge solenoid and canister, the fuel tank must be removed from the vehicle.

See Figure 4-50 and Figure 4-51 for purge solenoid circuitry diagrams.

1. See the service manual and properly remove the fuel tank from the vehicle.
2. If the charcoal canister requires removal, refer to the service manual and remove/replace as required.
3. Check all of the formed plastic hoses and rubber hoses for air leaks, cracks, breaks, chafing and/or physical deterioration/wear. See the service manual and replace any hoses found defective.
4. Proceed with flowcharts.

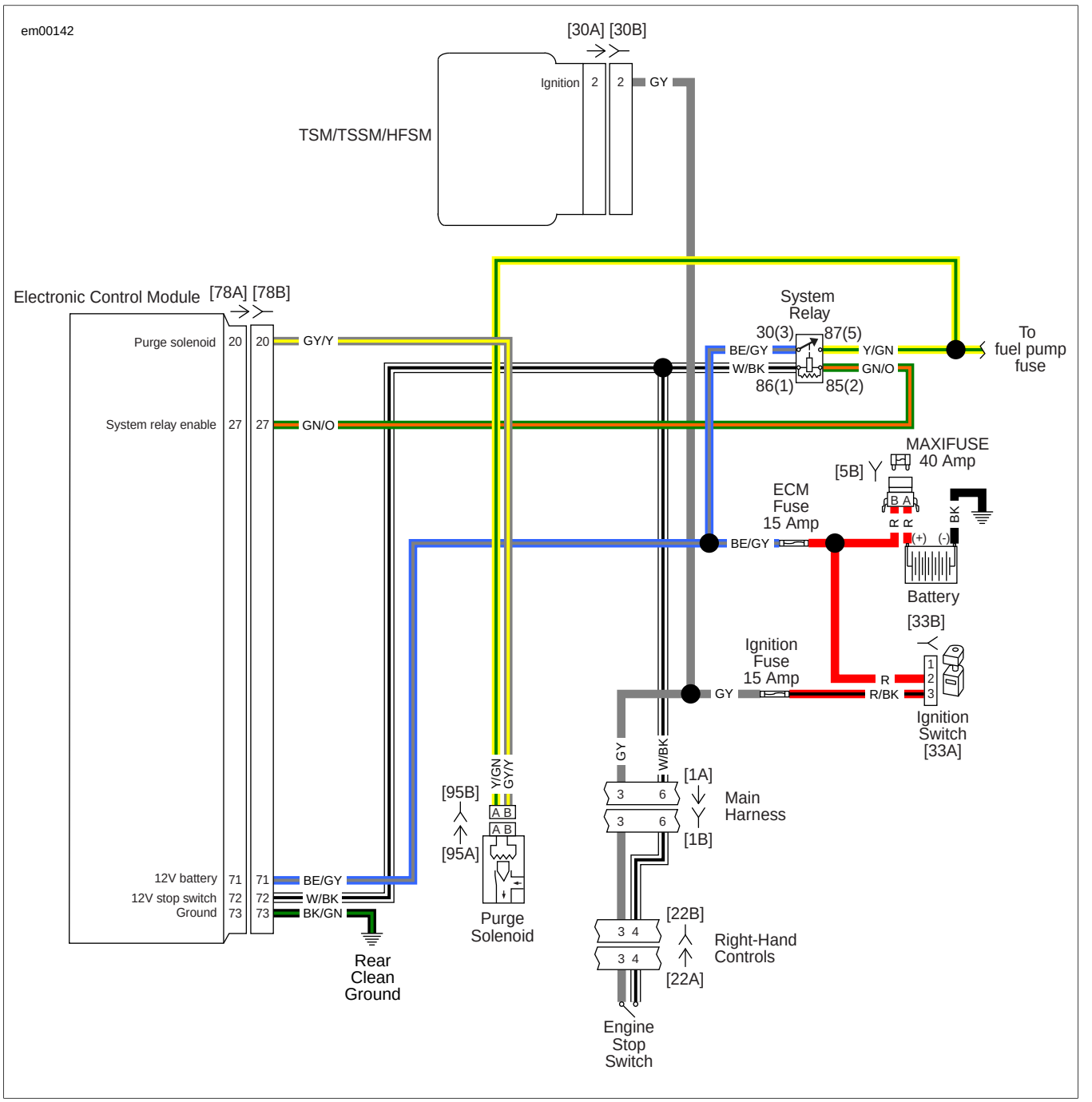


Figure 4-50. Purge Solenoid Circuit Diagram (FLHX, FLHT/C/U, FLTR)

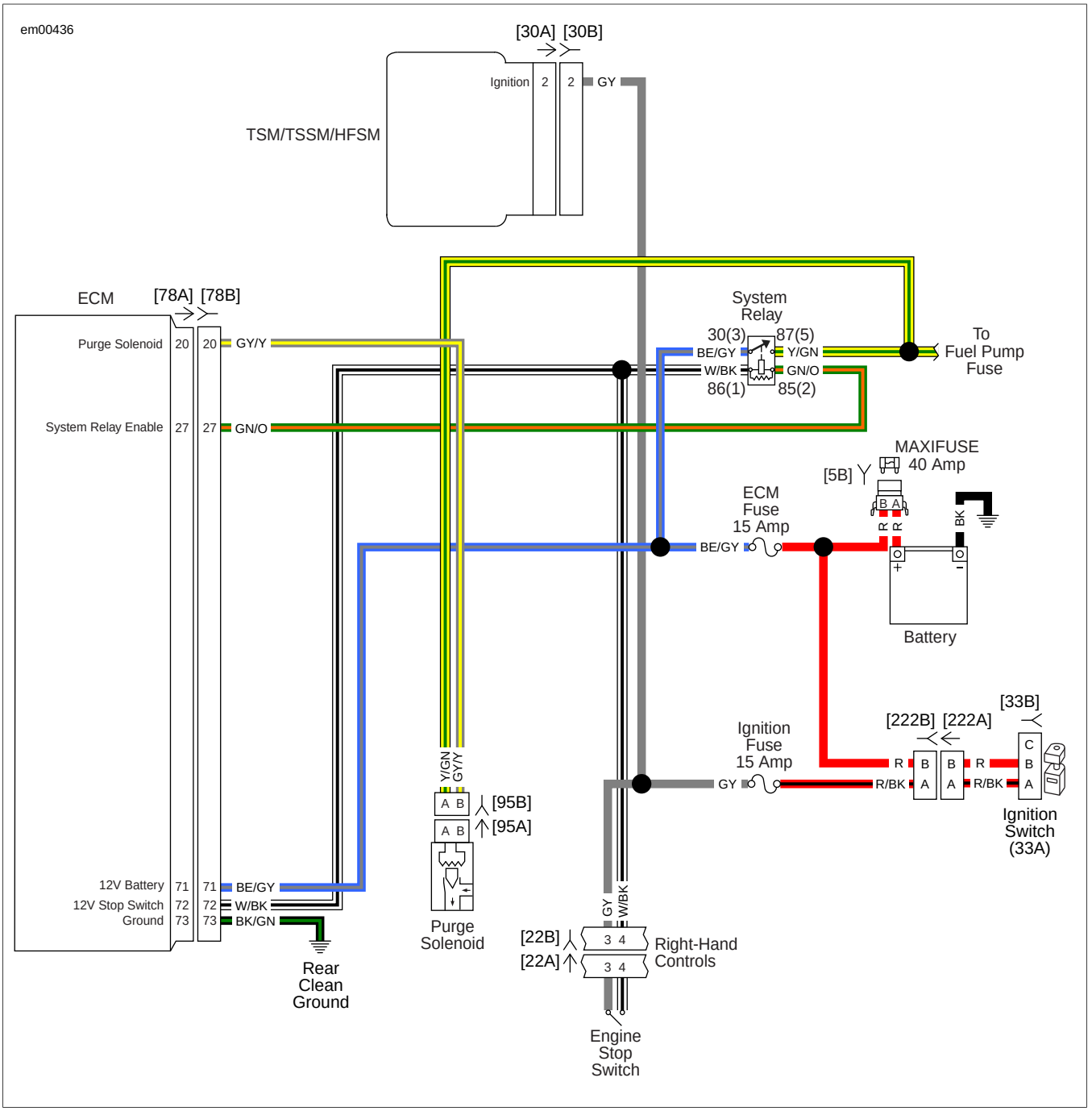
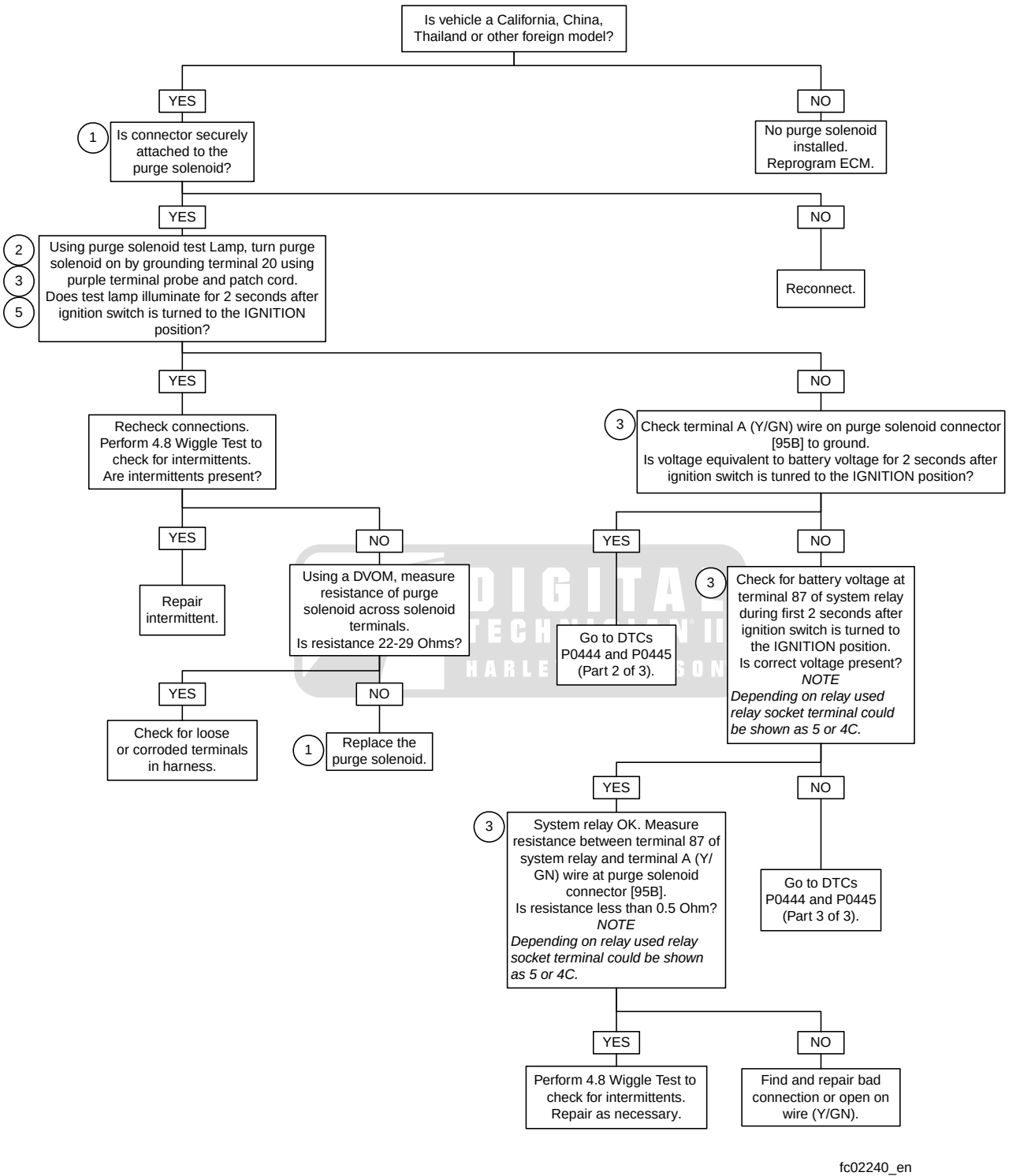


Figure 4-51. Purge Solenoid Circuit Diagram (FLHR/C)

Table 4-41. Wire Harness Connectors

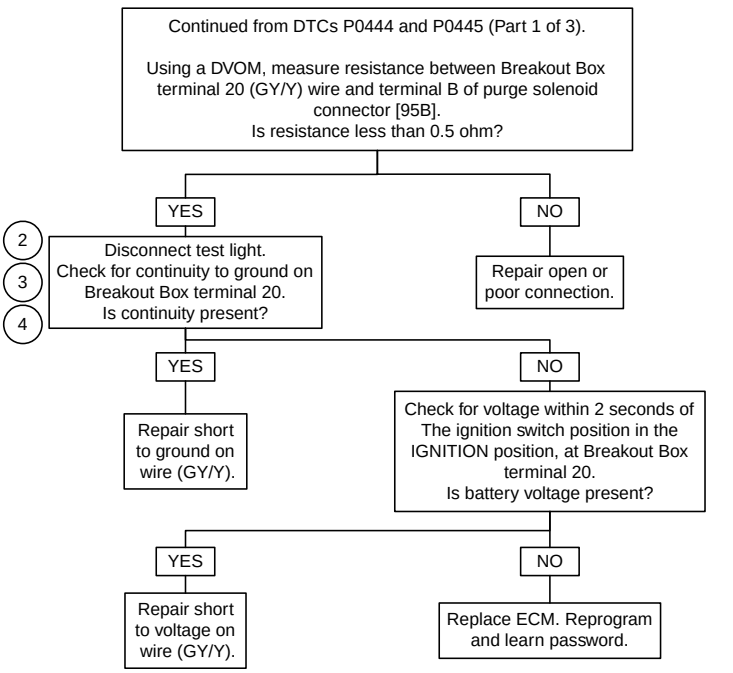
NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[33]	Ignition switch	All	3-place Packard	Under console
[78]	Electronic Control Module (ECM)	All	73-place Delphi	Under seat
[95]	Purge solenoid	All	2-place Packard	Under seat
[222]	Console ignition switch interconnect	FLHR/C	4-place Packard	Under seat

DTCs P0444 and P0445 (Part 1 of 3)



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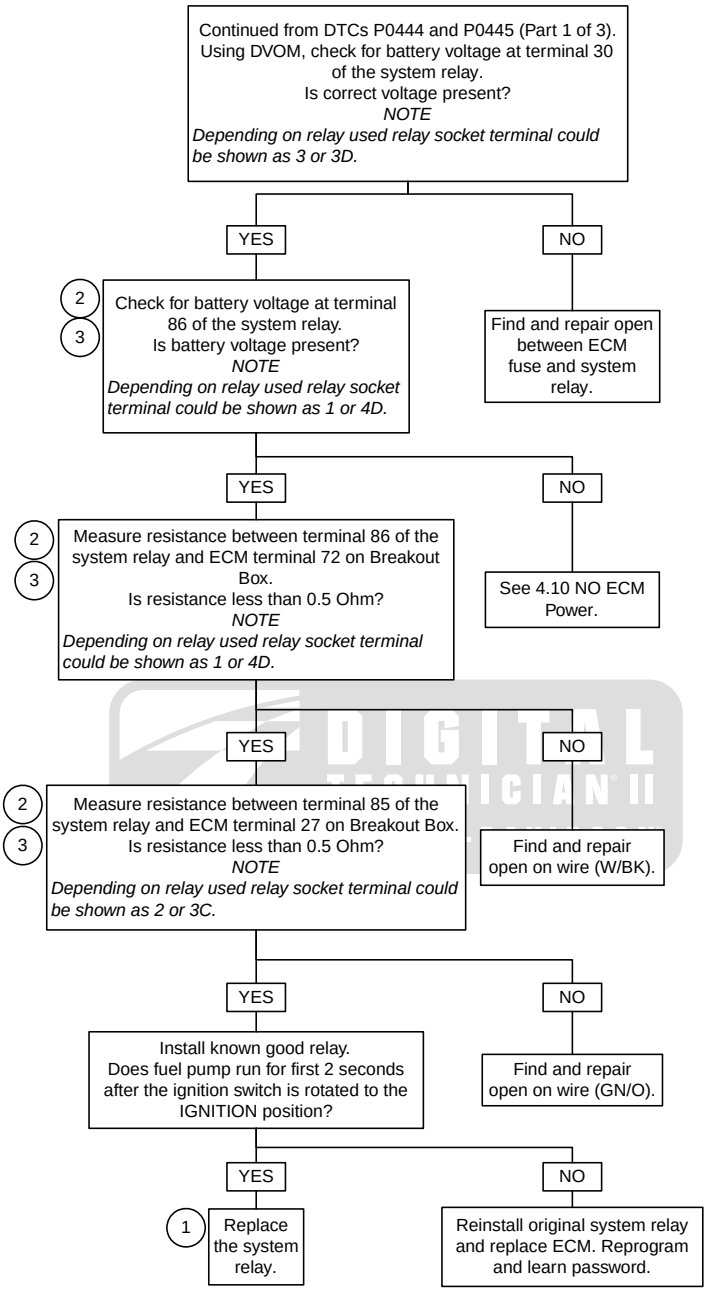
DTCs P0444 and P0445 (Part 2 of 3)



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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTCs P0444 and P0445 (Part 3 of 3)



fc02242_en

DTC P0501, P0502 4.23

GENERAL

Vehicle Speed Sensor (VSS)

See Figure 4-52. The VSS is powered and monitored by the ECM. The ECM processes the vehicle speed signal and transmits this signal to the TSM/TSSM/HFSM and speedometer through serial data.

NOTE

When the vehicle speed is greater than 0, the closed loop idle speed control is inhibited.

Table 4-42. Code Description

DTC	DESCRIPTION
P0501	VSS low
P0502	VSS high/open

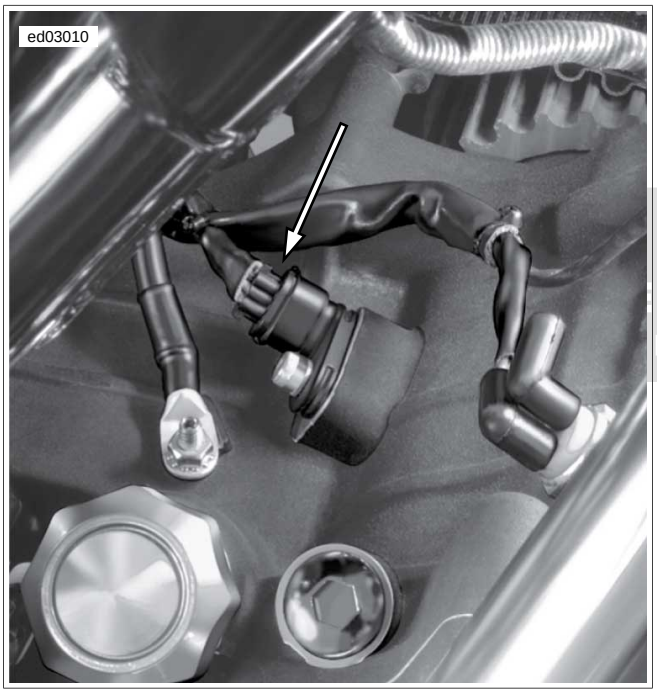


Figure 4-52. VSS Location (Under Starter)

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. The speedometer has a built-in diagnostic mode. See 4.6 SPEEDOMETER SELF-DIAGNOSTICS.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord.
3. Connect BREAKOUT BOX (Part No. HD-48637) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

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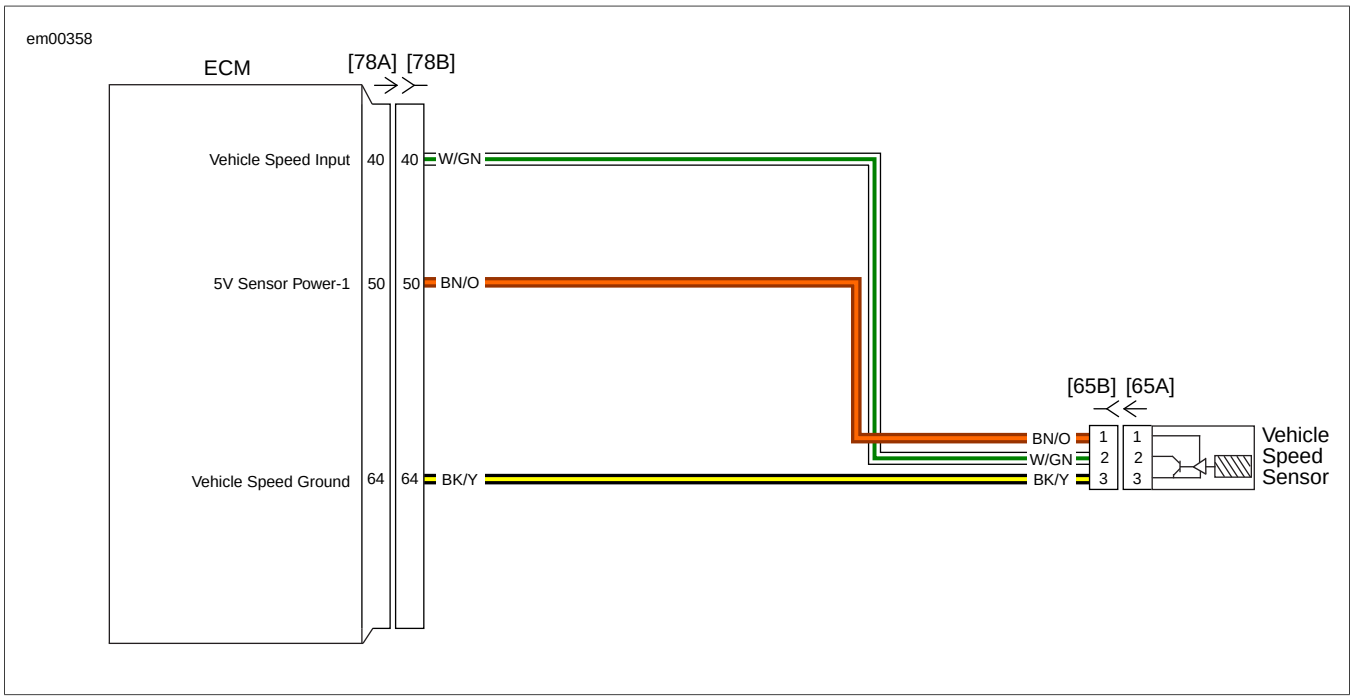


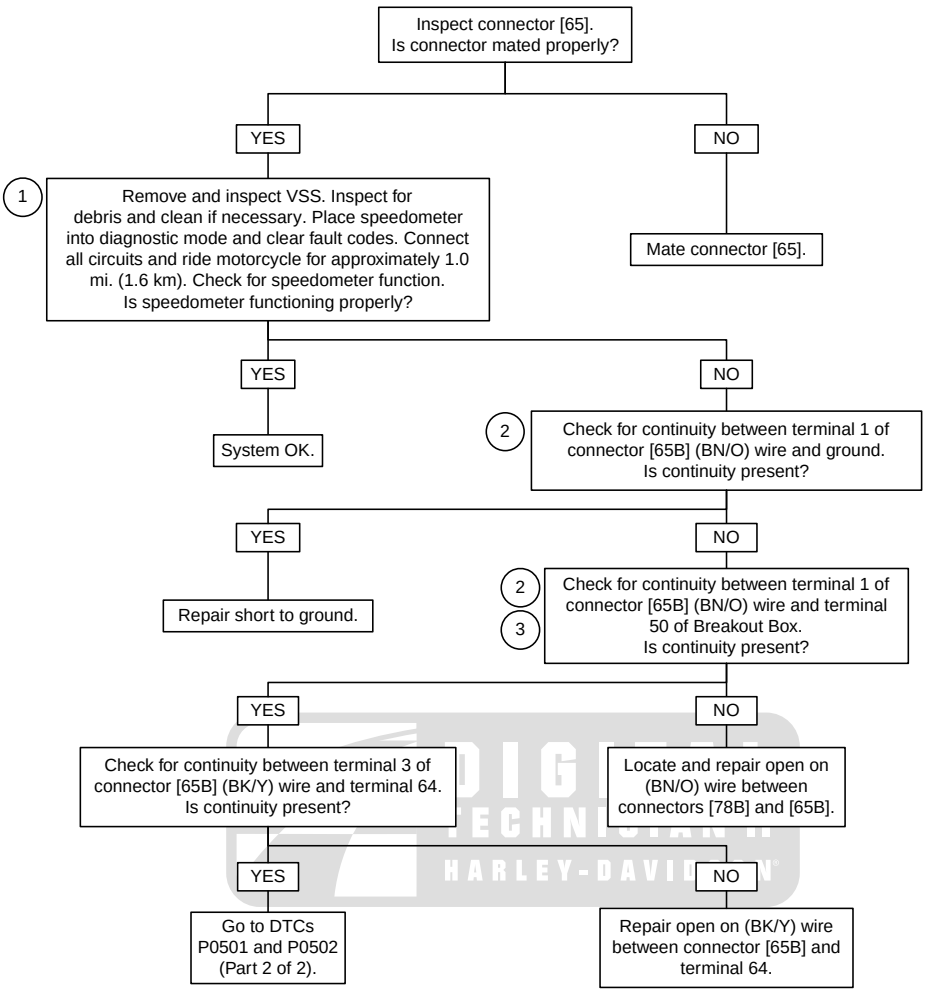
Figure 4-53. VSS Circuit Diagram

Table 4-43. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[65]	VSS	3-place Delphi	Top of transmission case (under starter)
[78]	ECM	73-place Delphi	Under seat

TECHNICIAN II HARLEY-DAVIDSON

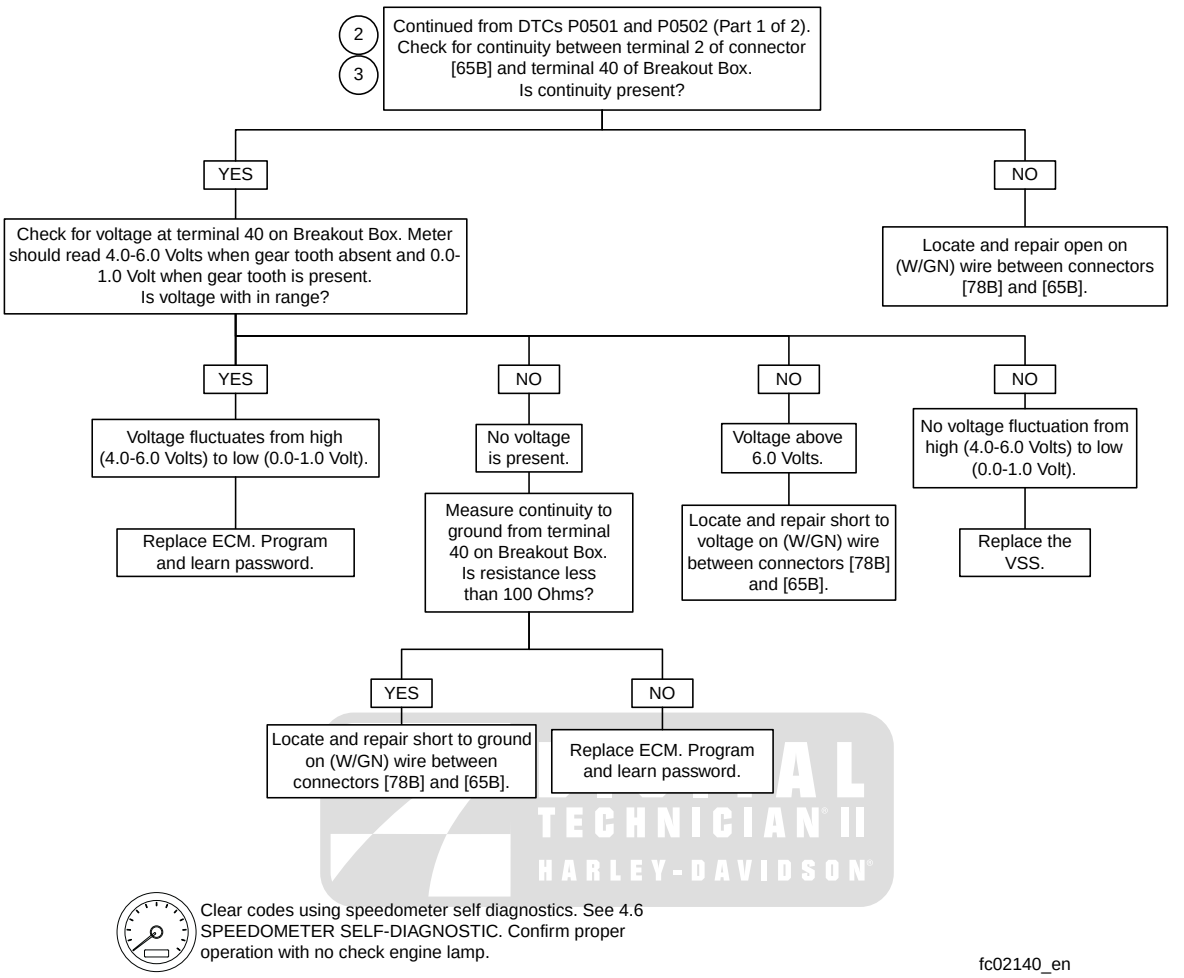
DTCs P0501 and P0502 (Part 1 of 2)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTCs P0501 and P0502 (Part 2 of 2)



TECHNICIAN II
HARLEY-DAVIDSON

DTC P0505 4.24

GENERAL

Loss of Idle Speed Control

The throttle control actuator uses a two wire DC motor to move the throttle plate from the spring loaded off-idle detent. The ECM supplies a pulse width modulated voltage signal through [78B] terminals 29 and 30. The ECM monitors throttle position through the dual position sensors (TPS1 and TPS2). This code will set if the throttle actuation faults cause the idle to become unstable. This can be caused by a loose TPS, throttle actuator friction, or an intermittent air leak.

NOTE

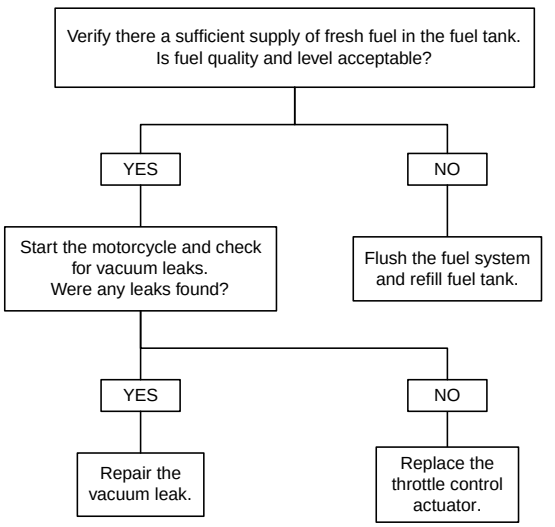
Although the ECM monitors terminals 29 and 30, faults on these terminals will not cause this DTC. Faults on these terminals will be higher priority DTCs, address them first.

Table 4-44. Code Description

DTC	DESCRIPTION
P0505	Loss of Idle Speed Control

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC P0505



fc02422_en

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC P0562, P0563 4.25

GENERAL

Battery Voltage

Battery voltage is monitored by the ECM (terminal 72). If the battery voltage fails to meet normal operating parameters, a code is set.

- When battery voltage at low RPM (less than 1300 RPM) is less than 12.5 Volts and battery voltage at high RPM (greater than 2000 RPM) minus battery voltage at low RPM is less than 0.25 Volt, then DTC P0562 is set after 100 counts (up to 15 seconds).
- DTC P0563 is displayed when battery positive voltage is greater than 15.0 Volts for more than 4 seconds.

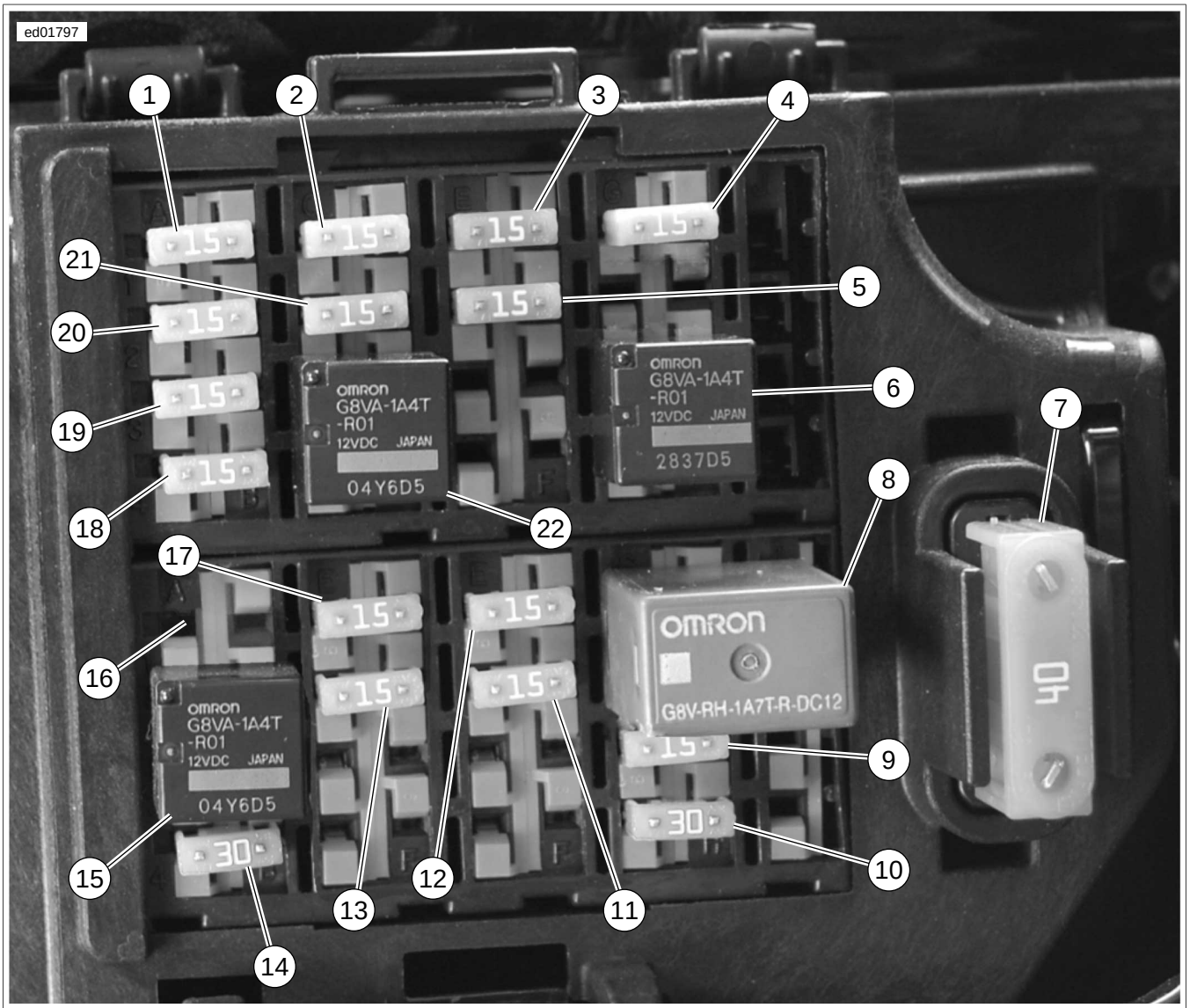
NOTES

- *Warm idle speed will automatically increase if battery voltage is low at idle.*
- *TSM/TSSM/HFSM problems may also set DTC P0562 or P0563.*

Table 4-45. Code Description

DTC	DESCRIPTION
P0562	Battery voltage low
P0563	Battery voltage high

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1. Brake/cruise
2. Accessory
3. P&A
4. Radio power/Siren
5. ECM power
6. Start relay
7. MAXIFUSE
8. Lighting relay
9. Spare
10. Spare
11. Lights
12. Ignition
13. Headlamp
14. ABS
15. Brake relay
16. P&A IGN (2A Max)
17. Instruments
18. Fuel pump
19. Exhaust control
20. Radio memory
21. Battery
22. System relay

Figure 4-54. Fuse and Relay Locations

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-48637	BREAKOUT BOX

Diagnostic Tips

- Low voltage generally indicates a loose wire, corroded connections, battery and/or a charging system problem.
- A high voltage condition may be caused by a faulty voltage regulator.

Diagnostic Notes

Each referenced number below correlates with a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
2. Use DVOM with RPM Pick-up to check RPM on vehicles without tachometers.

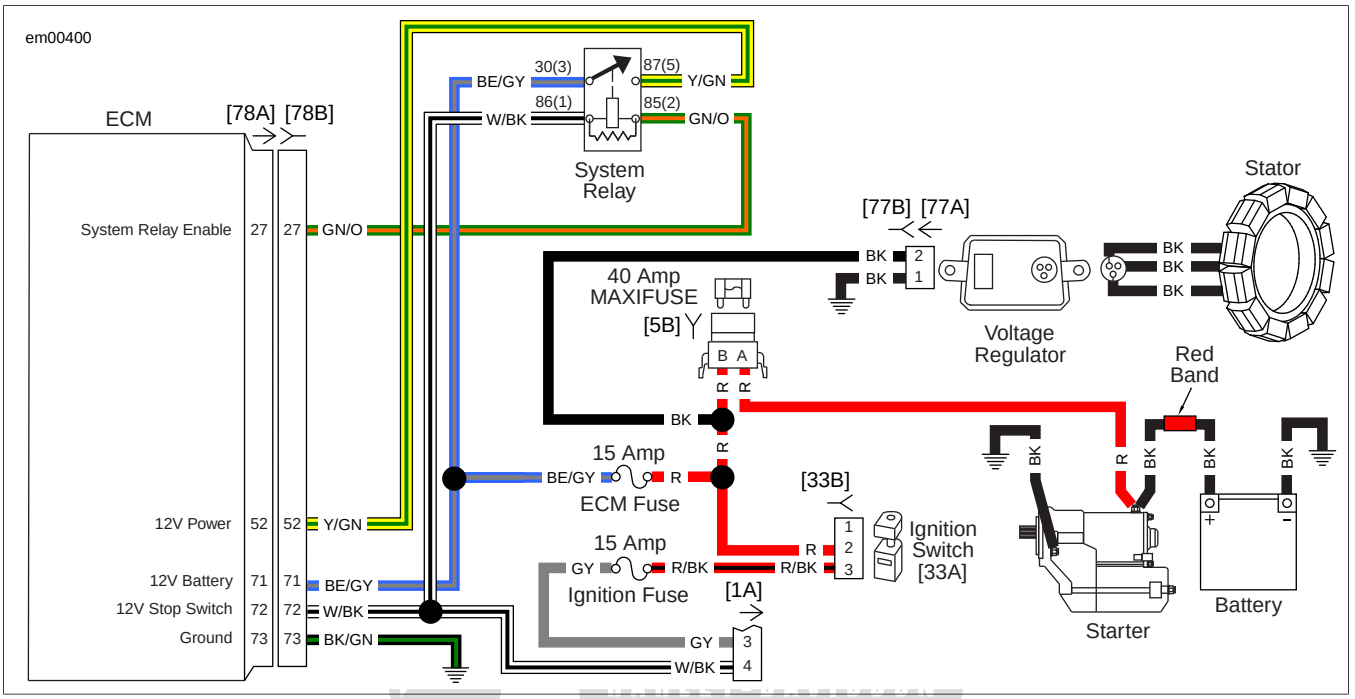


Figure 4-55. Battery Voltage Circuit Diagram (FLHX, FLHT/C/U, FLTR)

Table 4-46. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (black)	Inner fairing - right side below radio
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[33]	Ignition switch	All	3-place Packard	Bottom of ignition switch housing
[47]	Stator	All	3-place Lyall	Bottom of voltage regulator (left side)
[78]	ECM	All	73-place Delphi	Under seat

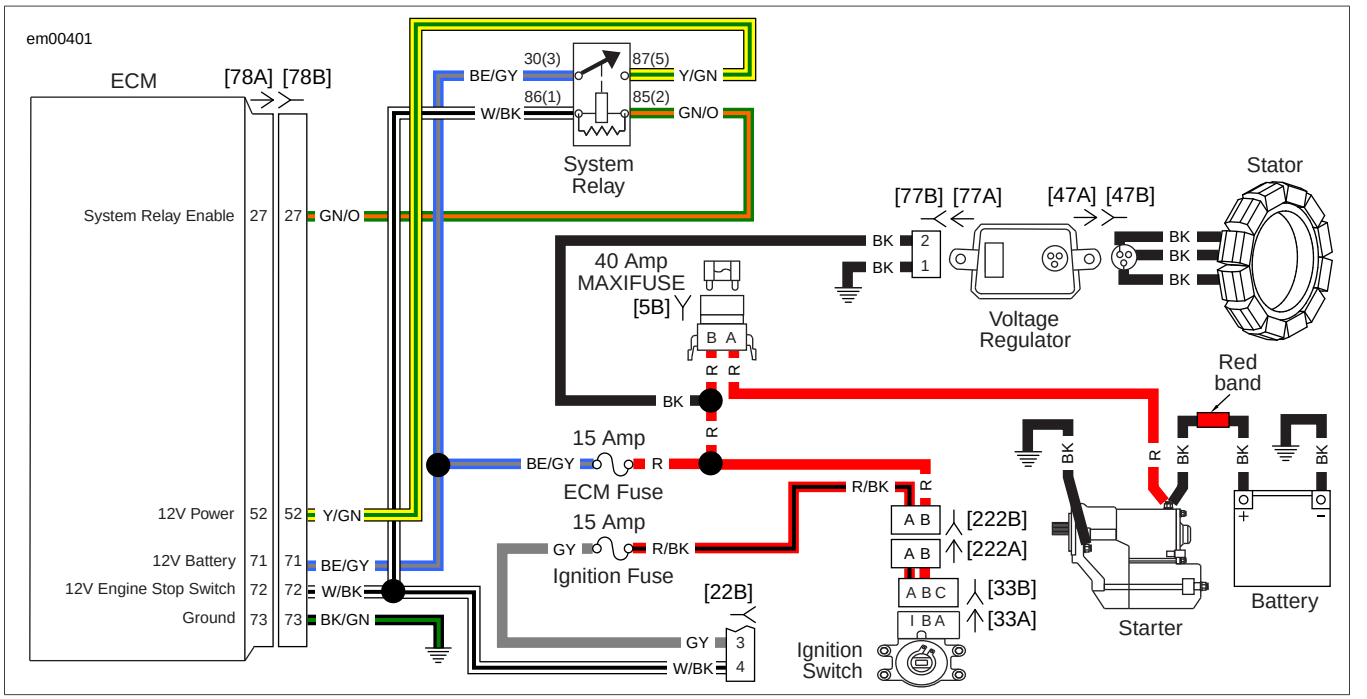
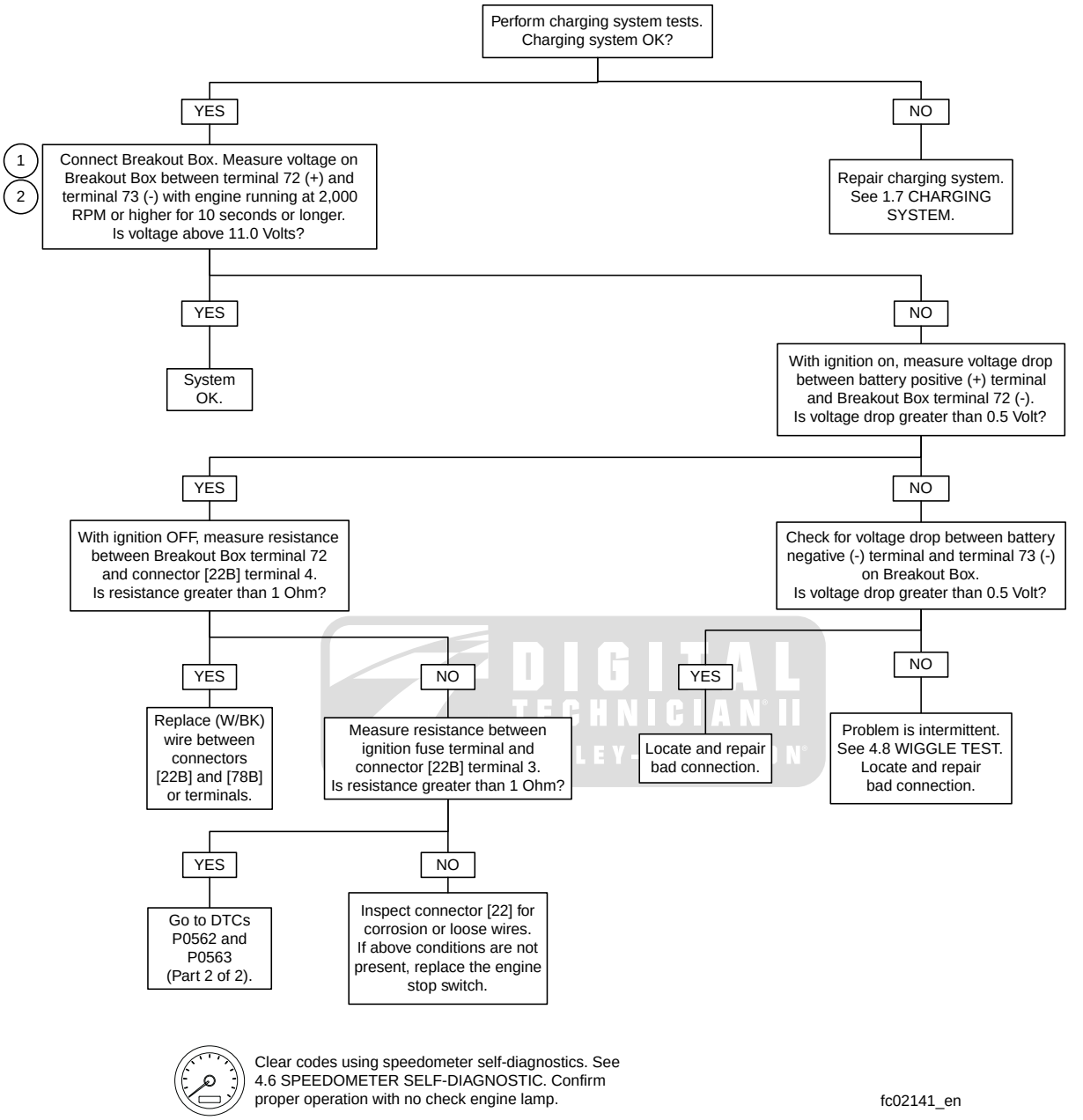


Figure 4-56. Battery Voltage Circuit Diagram (FLHR/C)

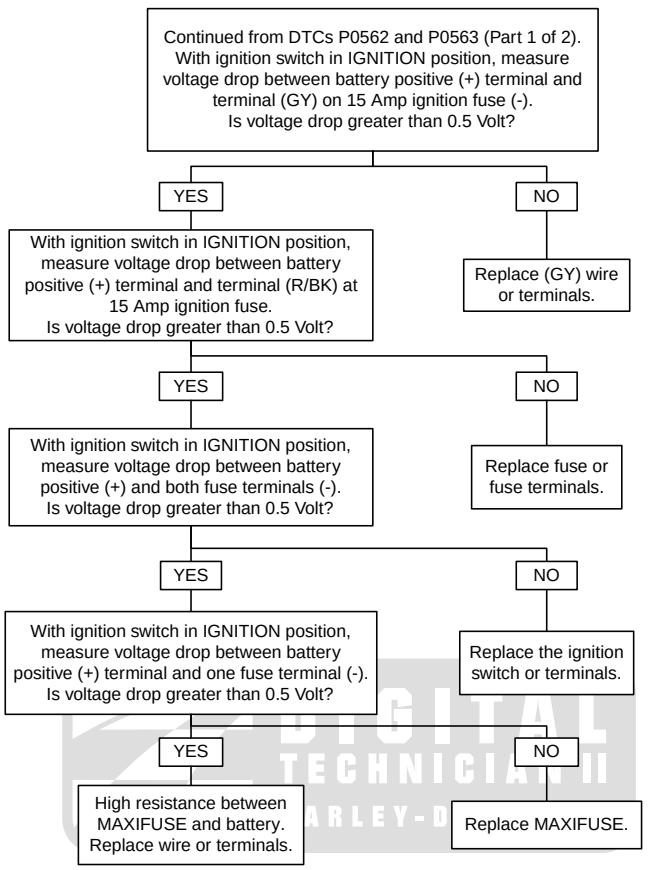
Table 4-47. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[5]	MAXIFUSE	2-place Packard	Under left side cover
[22]	Right handlebar switches	6-place Molex (black)	Inside headlamp nacelle - fork stem nut lock plate (right side)
[33]	Ignition switch	3-place Packard	Under console
[47]	Stator	3-place Lyall	Bottom of voltage regulator (left side)
[78]	ECM	73-place Delphi	Under seat
[222]	Main to ignition harness	4-place Packard	Rear of fuel tank (under seat)

DTCs P0562 and P0563 (Part 1 of 2)



DTCs P0562 and P0563 (Part 2 of 2)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTC P0572 4.26

GENERAL

Brake Switch

There are two stop lamp switches. The front stop lamp switch is a mechanical switch located on the right hand controls. The rear brake switch is a pressure switch located in the brake line under the exhaust pipes.

On vehicles not equipped with ABS, when the stop lamp switches are closed they supply power to the coil side of the brake relay. This energizes the brake relay and supplies power to the stop lamp. The stop lamp switches also supply an input to the ECM.

On vehicles equipped with ABS, when the stop lamp switches are closed each switch supplies a separate input to the ABS module. Power is also supplied through the ABS diode pack to the ECM (as a brake input) and to the brake relay. The brake relay energizes and supplies power to the stop lamps.

During an ignition cycle, the ECM must receive a valid brake switch input. During the same ignition cycle the vehicle has to reach 31 MPH (50 km/h) in third gear or higher and return to a stop three times with out any brake switch signals in order to set DTC P0572.

Table 4-48. Code Description

DTC	DESCRIPTION
P0572	Brake switch input error

DIAGNOSTICS

Diagnostic Tips

- Make sure the rear brake reservoir has the proper amount of brake fluid, and there are no apparent leaks. If fluid is low, the rear brake switch may not receive sufficient pressure to actuate the switch. Replenish brake fluid in the brake reservoir(s), as necessary.
- An intermittent may be caused by poor connection, rubbed through wire insulation or an inoperative wire inside the insulation.

Check for the following conditions:

- **Poor connection**: Inspect component and harness connectors for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harnesses.
- **Fluid leaks**: Check the rear brake switch for fluid leaks around the seal of the switch. Refer to the service manual to repair a fluid leak.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. When checking the (O/W) wire, from the accessory fuse for a short to ground, remember to check the wires on the other side of the switches for shorts to ground as well. These circuits could cause a short to the accessory fuse but only when the switch is closed. The accessory fuse circuit supplies power to the cigar lighter, horn, left and right turn signal switches, front and rear brake switches and the cruise control switch.

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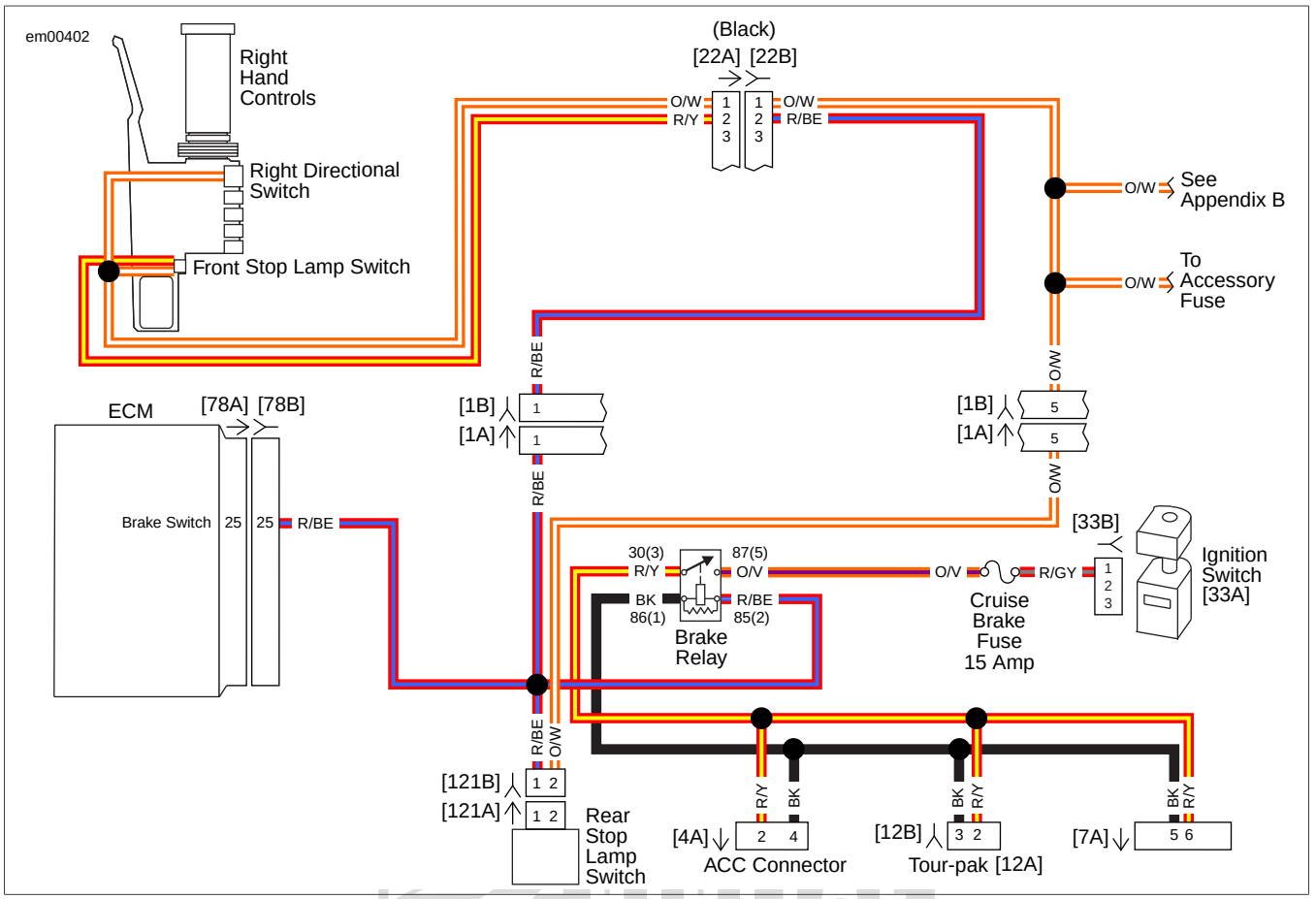


Figure 4-57. Brake Control Circuit Without ABS (FLHX, FLHT/C/U, FLTR)

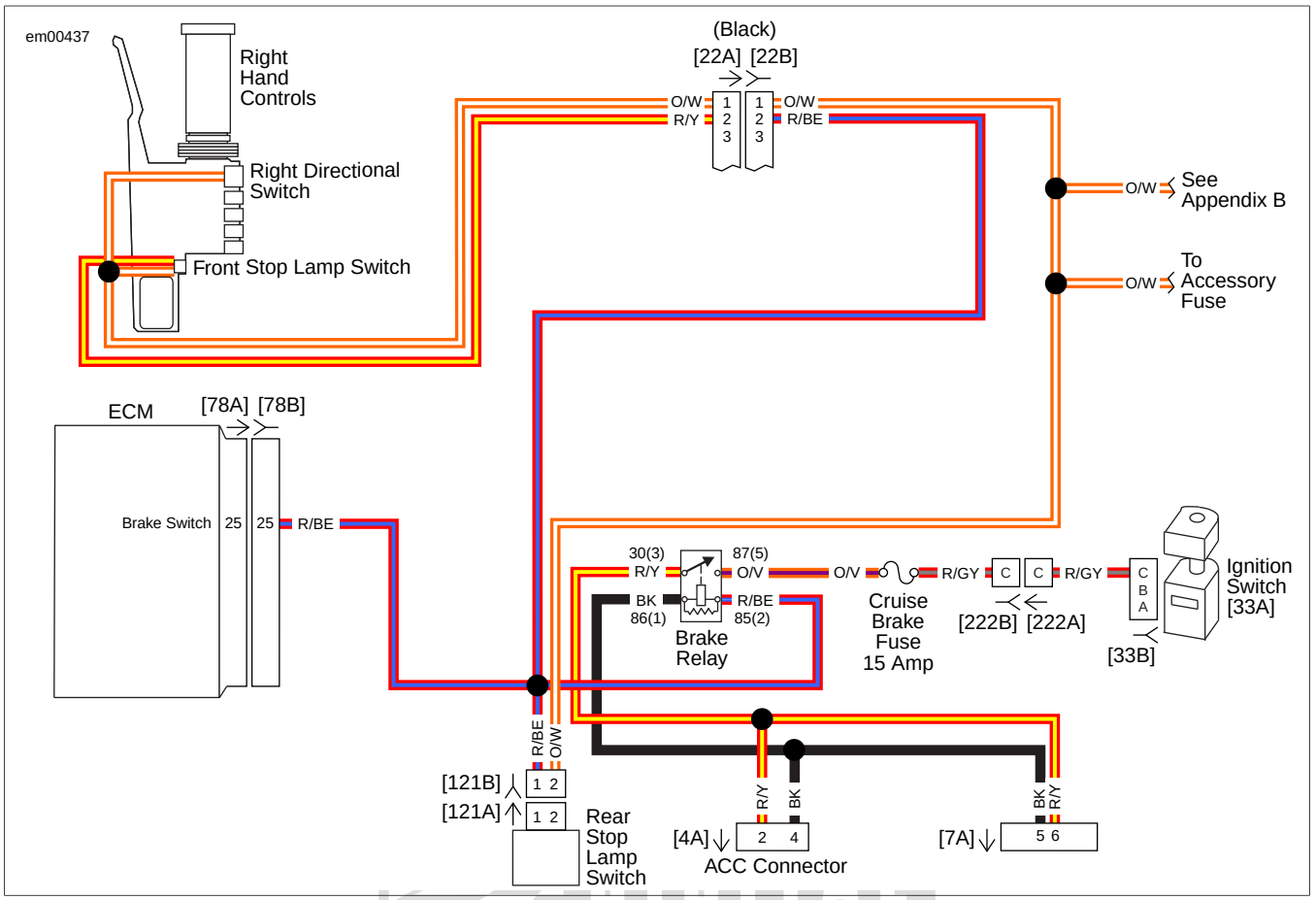


Figure 4-58. Brake Control Circuit Without ABS (FLHR/C)

Table 4-49. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side (below radio)
[2]	Main to interconnect harness	FLHT/C	12-place Molex (Gray)	Inner fairing - left fairing support bracket
		FLTR	12-place Molex (Gray)	Inner fairing - below radio (right side)
[4]	Accessory connector	All	4-place Deutsch (Black)	Under seat
[7]	Rear fender lights harness	All	8-place Multilock	Top of rear fender (under seat)
[12]	Tour-Pak lights (rear fascia lamp on FLHX)	All	3-place Multilock	Inside Tour-Pak (inboard of upper frame tube on FLHX)
[22]	Right handlebar switches	FLHT/C	12-place Molex (Black)	Inner fairing - right fairing support bracket
		FLTR	12-place Molex (Black)	Inner fairing - left radio bracket
		FLHR/C	6-place Molex	Inside headlamp nacelle - fork stem nut lock plate (right side)
[33]	Ignition switch	FLHT/C/U/X, FLTR	3-place Packard	Bottom of ignition switch housing
		FLHR	3-place Packard	Under console
[78]	ECM	All	73-place Delphi	Under seat
[108]	Tachometer	FLHT/C	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)

Table 4-49. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[121]	Rear brake switch	All	2-place Delphi	Mid chassis, lower right side (between frame and exhaust pipe)
[222]	Main to ignition harness	FLHR/C	4-place Packard	Rear of fuel tank (under seat)

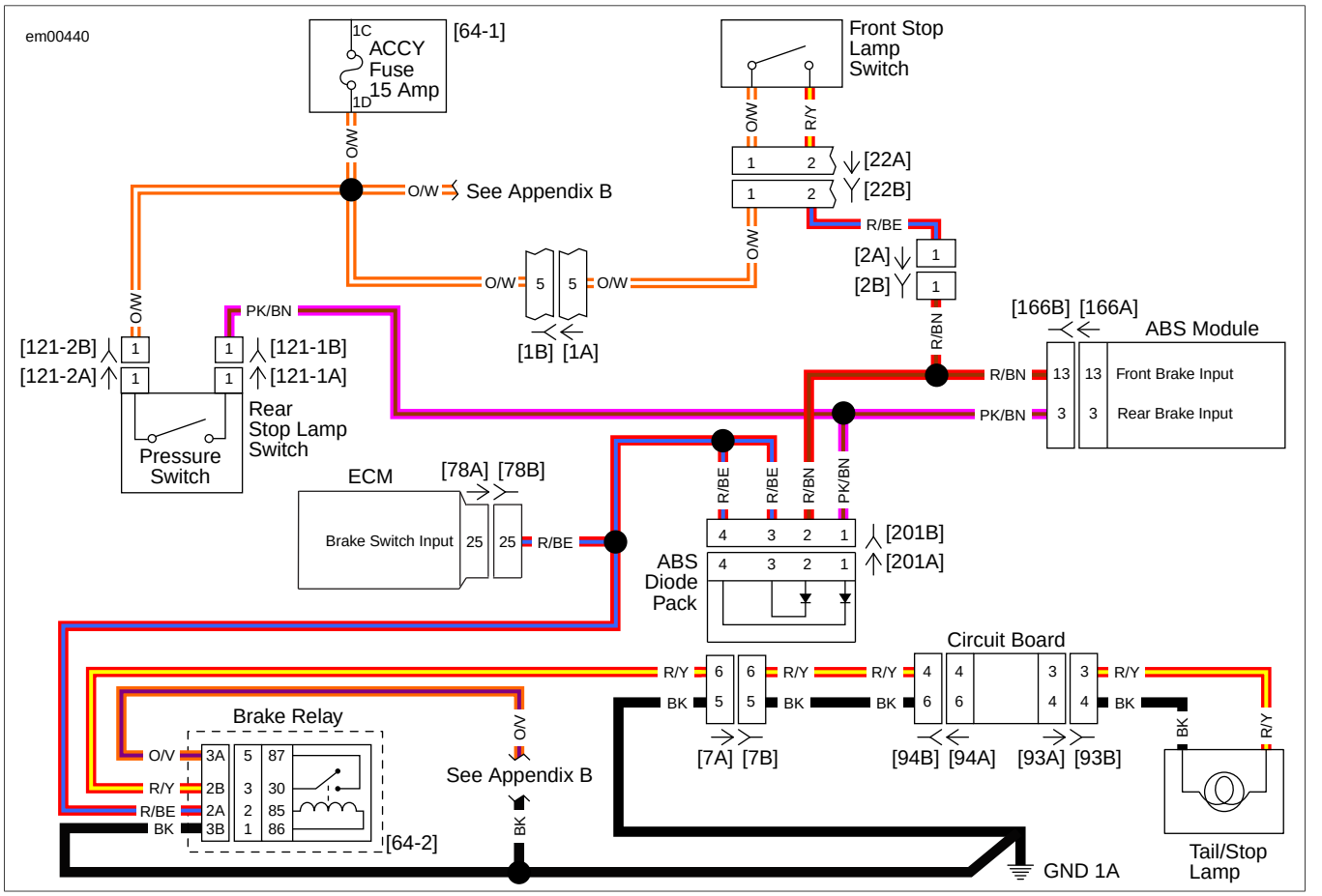


Figure 4-59. Brake Control Circuit With ABS (FLHX, FLHT/C/U, FLTR)

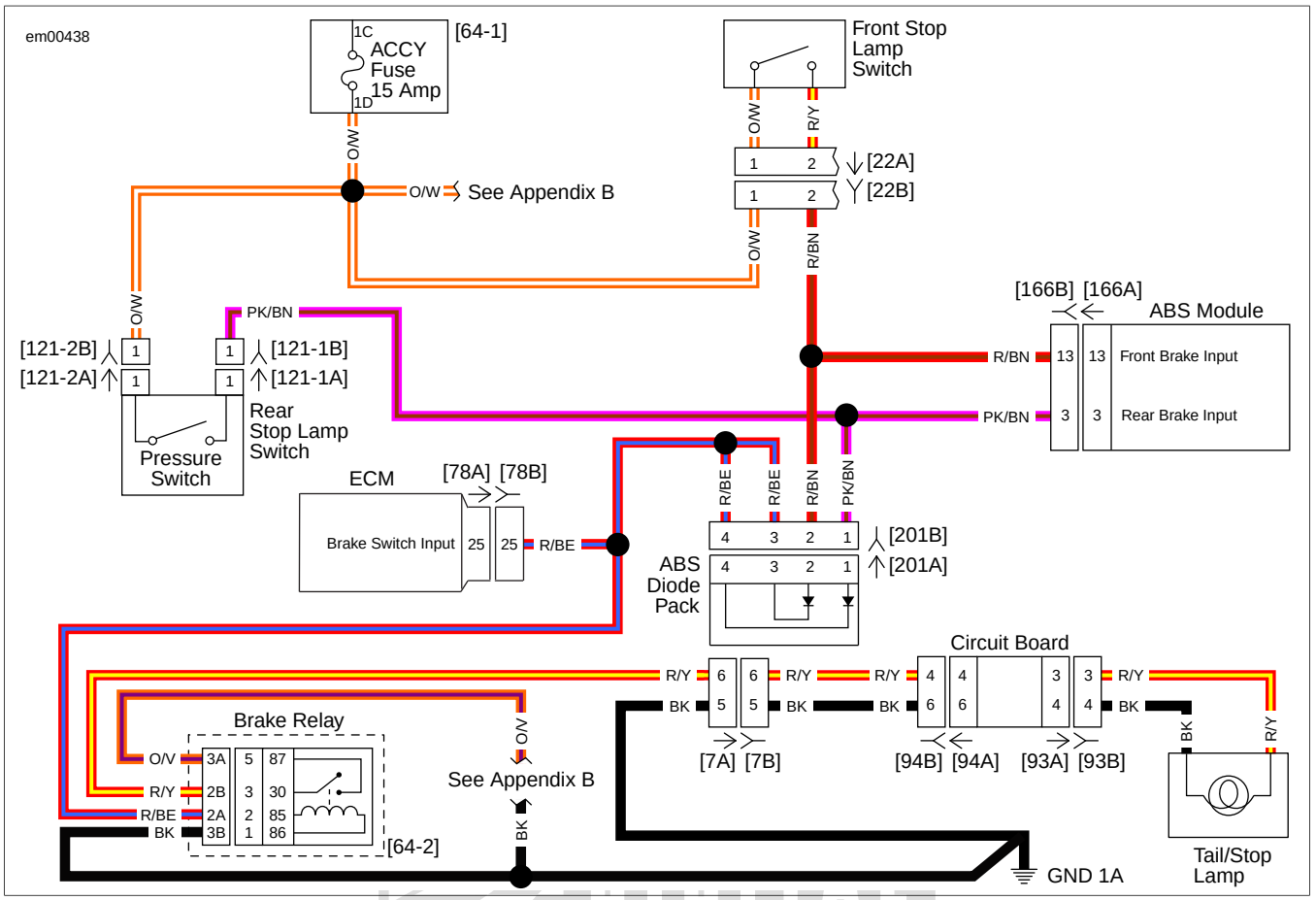
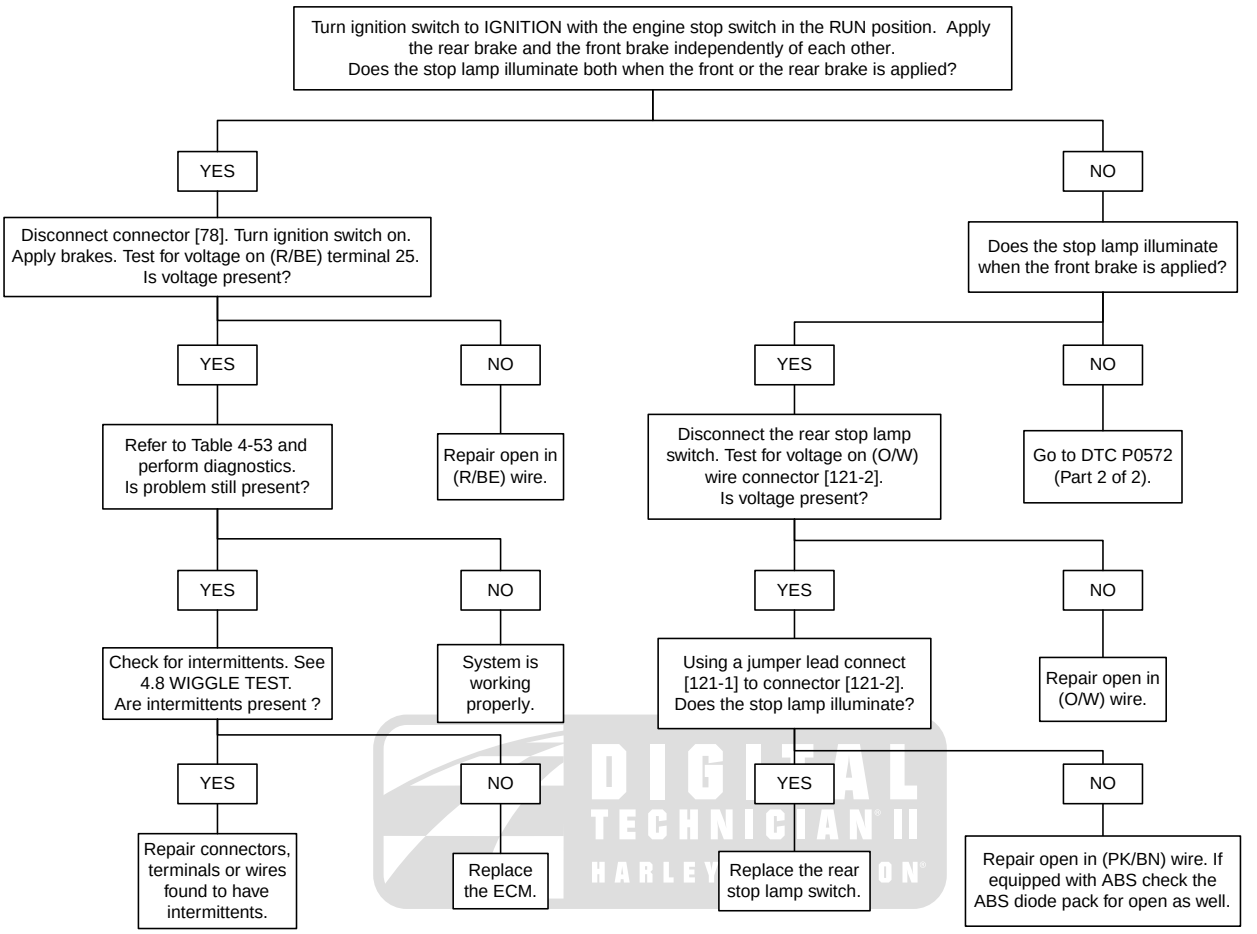


Figure 4-60. Brake Control Circuit With ABS (FLHR/C)

Table 4-50. Wire Harness Connectors

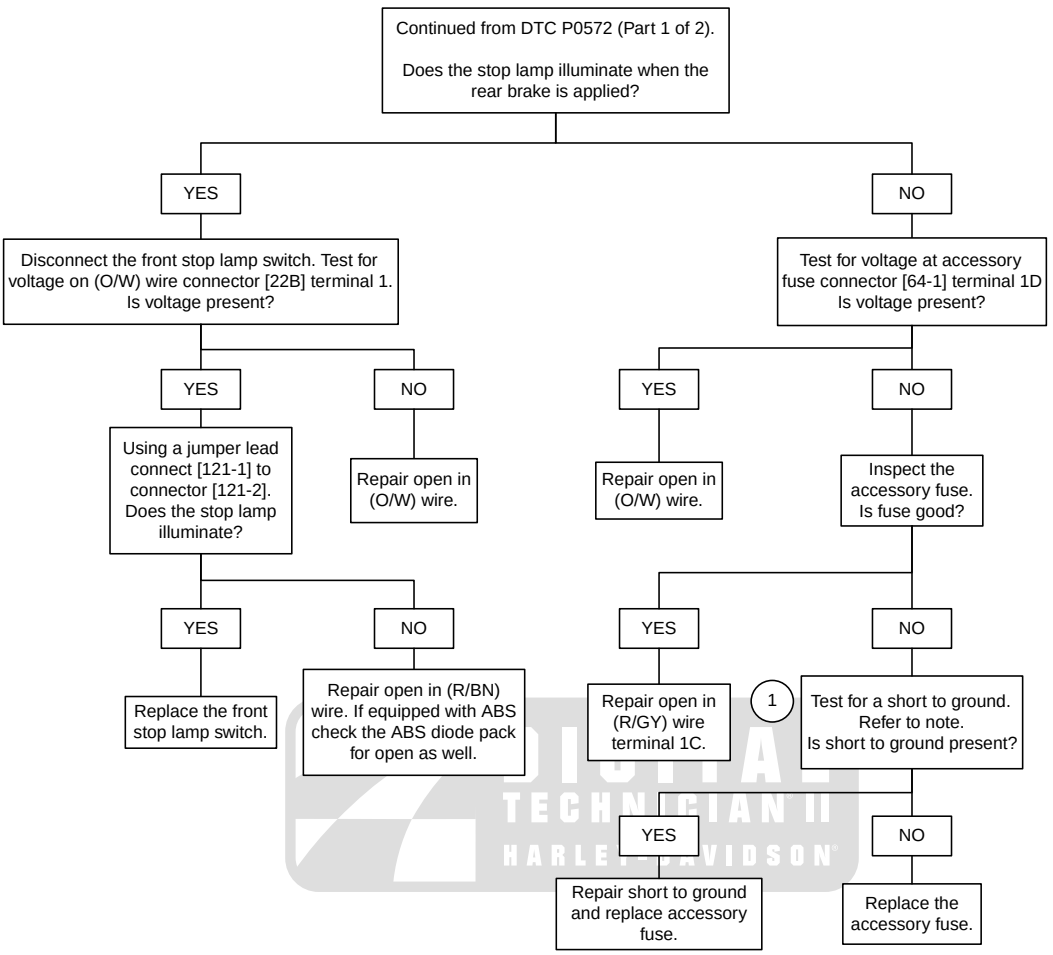
NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side (below radio)
[7]	Rear fender lights harness	All	8-place Multilock	Top of rear fender (under seat)
[22]	Right handlebar switches	FLHT/C	12-place Molex (Black)	Inner fairing - right fairing support bracket
		FLTR	12-place Molex (Black)	Inner fairing - left radio support bracket
		FLHR/C	6-place Molex	Inside headlamp nacelle - fork stem nut lock plate (right side)
[64]	Fuse block	All	Packard	Under left side cover
[78]	ECM	All	73-place Delphi	Under seat
[93]	Tail lamp	All	4-place Multilock	Circuit board under tail lamp assembly
[94]	Rear fender lights harness in circuit board	All	6-place Multilock	Circuit board under tail lamp assembly
[121]	Rear brake light switch	All	Spade terminals	Mid chassis, lower right side (between frame and exhaust pipe)
[166]	ABS module	All	20-place Molex	Under right side cover
[201]	ABS diode	All	4-place Deutsch	Under left side cover (below fuse/relay block)
[222]	Main to ignition harness	FLHR/C	4-place Packard	Rear of fuel tank (under seat)

DTC P0572 (Part 1 or 2)



fc02423_en

DTC P0572 (Part 2 or 2)



fc02424_en

DTC P0577 4.27

GENERAL

Cruise Control

The ECM controls and monitors the operation of the vehicle cruise control. The cruise switch allows the control circuit to be enabled or disabled and, when enabled, the lamp in the switch illuminates.

Actual engagement of the vehicle cruise control is provided by the cruise SET/RESUME switch, located on the operator right hand controls. This switch is a three position momentary switch, spring loaded to the center position.

Switch-Right Position (SET/COAST)

- When the switch is toggled to the right position and released, the cruise control is engaged and set to current vehicle speed.
- If the switch is toggled right and held momentarily, then the cruise control enters the COAST mode.

Switch-Left Position (RESUME/ACCELERATE)

- After brakes are applied or throttle is forced towards the stop, the clutch is disengaged, and the cruise control is disengaged. When the switch is toggled to the left position then released, the cruise control is engaged and will resume the previously set speed/condition.
- If the switch is toggled left and held momentarily while the cruise control is engaged, acceleration is provided, increasing the vehicle RPM/speed. If the switch is toggled left and held, it continues to increase the vehicle speed until the switch is released and allowed to return to the neutral position.

Table 4-51. Code Description

DTC	DESCRIPTION
P0577	Cruise Control Input Error

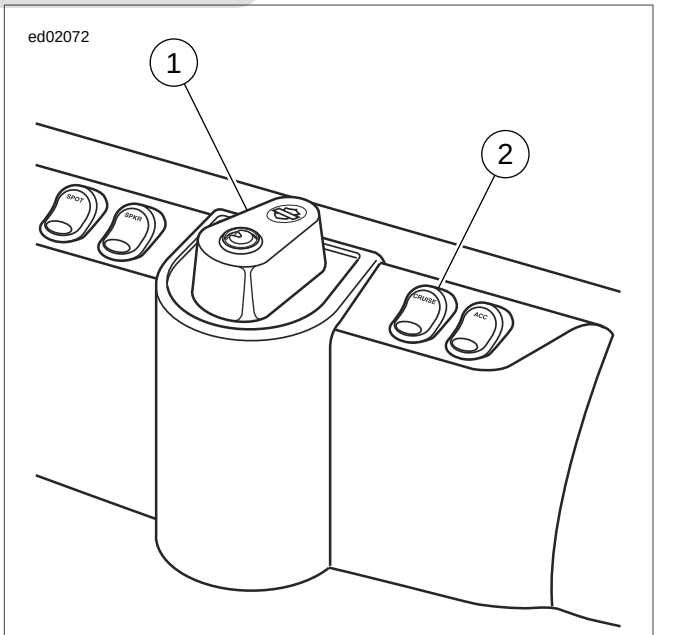
SYSTEM OPERATION

To engage and disengage the cruise control system, proceed as follows:

1. While riding in fourth, fifth, or sixth gear, turn the cruise on/off switch to the ON (lamp illuminated) position. See Figure 4-61. The switch is located on the fairing cap of FLHTCU models, the instrument nacelle of FLTR models, and the left handlebar lower switch housing on FLHRC models. The cruise enabled/engaged lamp in the tachometer face (speedometer on FLHRC models) turns orange to indicate the system is activated. See Figure 4-63. An orange lamp in the switch on both FLHTCU and FLTR models also indicates this condition to the rider.
2. See Figure 4-62. With the motorcycle traveling at the desired cruise speed, 30-85 MPH (48-137 km/h), momentarily push the cruise SET/RESUME switch to SET.
3. See Figure 4-63. The ECM monitors the VSS to establish the desired vehicle speed. The ECM then modulates the throttle control actuator to maintain vehicle speed. The cruise enabled/engaged lamp in the tachometer face (speedometer on FLHRC models) turns from orange to green to indicate the cruising speed is locked in.
4. The ECM monitors both the engine RPM and the VSS output speed signal. The ECM signals the throttle control actuator to open or close the throttle to keep the speedometer output speed signal constant. The engine RPM is monitored to detect engine overspeed, a condition which automatically causes cruise disengagement.
5. The ECM automatically disengages cruise mode whenever the ECM receives one of the following inputs:
 a. front or rear brake is applied.
 b. throttle is "rolled back" or closed, thereby actuating throttle roll-off (disengage) command.
 c. motorcycle clutch is disengaged (ECM senses too great an increase in RPM).
 d. cruise on/off switch placed in the off position.
 e. handlebar-mounted engine stop switch placed in the off position.
 f. handlebar-mounted cruise SET/RESUME switch is pushed to SET and held in that position until vehicle speed drops below 30 MPH (48 km/h) or pushed to RES until vehicle speed exceeds 85 MPH (137 km/h).

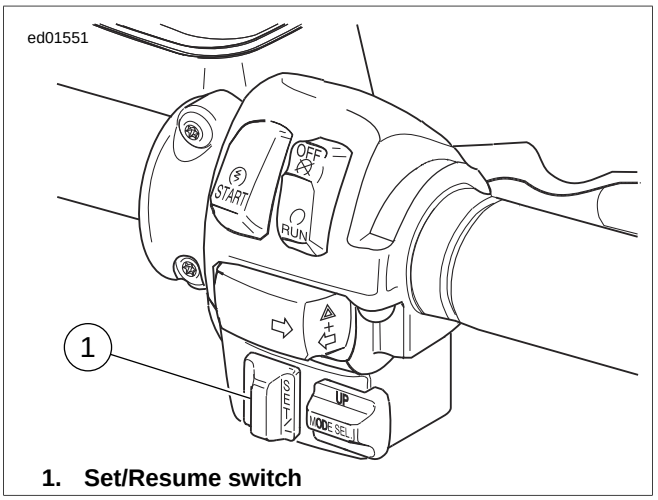
NOTE

If the vehicle speed is above 30 MPH (48 km/h) when the cruise SET/RESUME switch is released, then the cruise system automatically re-engages.



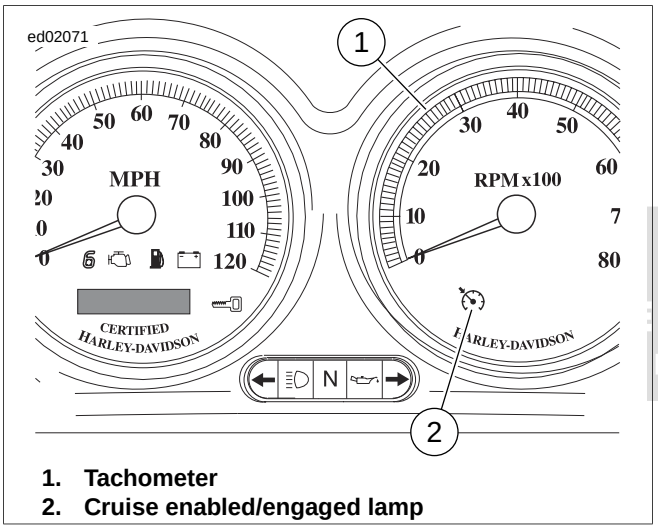
1. Ignition switch
2. Cruise on/off switch

Figure 4-61. Fairing Cap (FLHTCU)



1. **Set/Resume switch**

Figure 4-62. Right Handlebar Switch Assembly (FLTR, FLHTCU)



1. **Tachometer**
2. **Cruise enabled/engaged lamp**

Figure 4-63. Instrument Panel (FLHTCU - typical)

TROUBLESHOOTING

The ECM provides on-board diagnostics to help isolate any problems that occur with the cruise system.

If the cruise is inoperative or fails to set, begin troubleshooting with Table 4-53. If the cruise seems to disengage or drop out for no apparent reason, see Cruise Control Inoperative: DTC P0577 (Part 1 of 2).

In the diagnostic mode, the cruise enabled/engaged lamp is employed as a test indicator. The lamp is in the tachometer face (speedometer on FLHRC models). See Figure 4-63.

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Tips

- An intermittent may be caused by poor connection, rubbed through wire insulation or an inoperative wire inside the insulation.
- **Poor connection**: Inspect component and harness connectors for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harnesses.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) to the ECM and ECM harness. See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes, socket probes and patch cords.
3. Replace defective mechanical components in accordance with the service manual. Follow the flowchart steps provided until component replacement directs you to the service manual.
4. If the cruise engaged lamp (green) does not illuminate at all, check for one or more of the following conditions:
 a. SET/RESUME switch faulty or not wired correctly.
 b. inoperative or pinched wire to SET switch.
 c. cruise engaged lamp burned out or miswired.
 d. faulty cruise main switch and associated wiring.
 e. brake light on constantly.
5. Repeat Step 1 if the cruise engaged lamp still does not illuminate, see Cruise Control: Initial Diagnostics. Repair any problems then recheck by repeating Step 1.
6. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray female probe and patch cord.

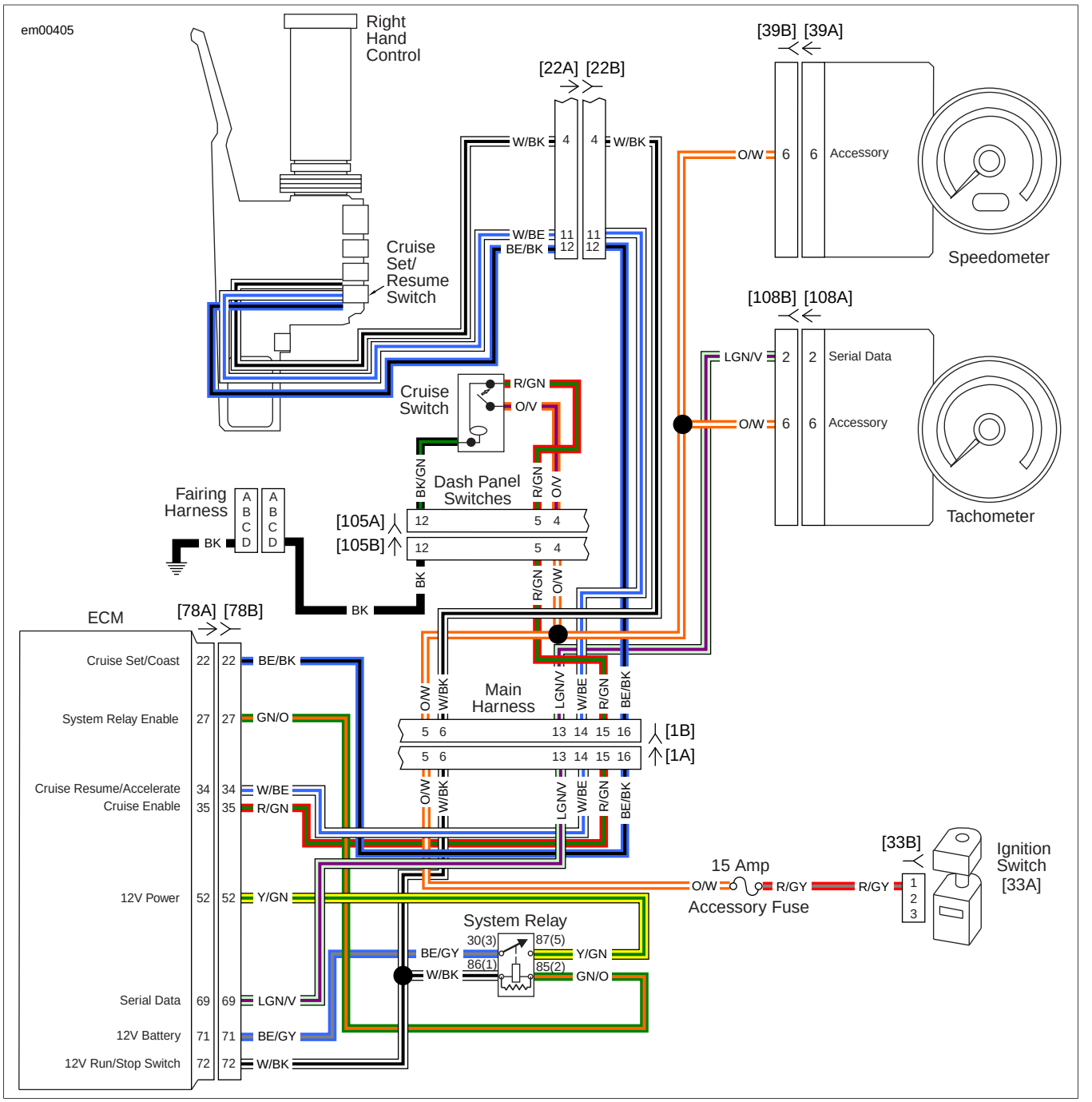


Figure 4-64. Cruise Control Circuit Diagram (FLHX, FLHT/C/U, FLTR)

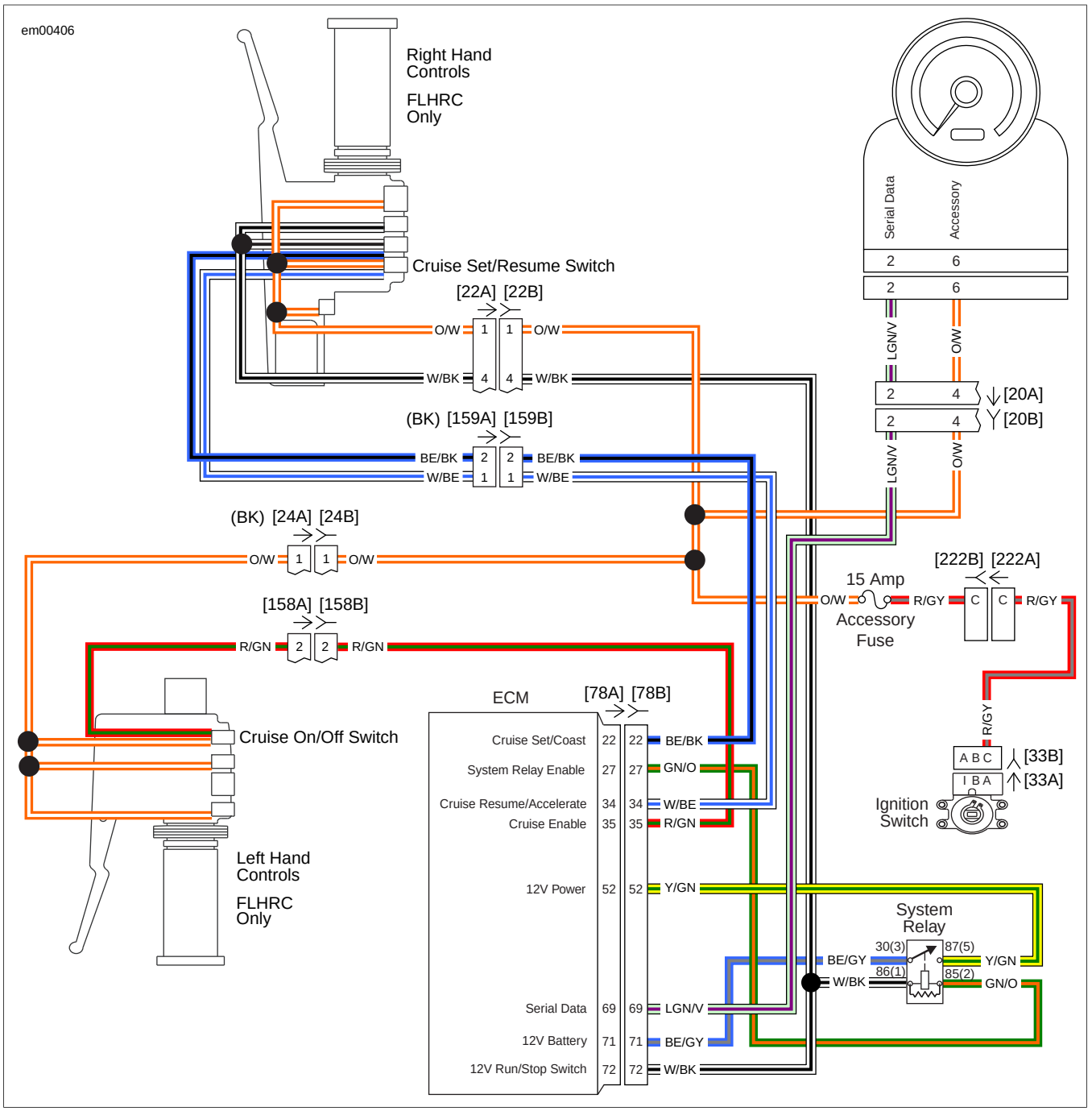


Figure 4-65. Cruise Control Circuit Diagram (FLHR/C)

Table 4-52. Wire Harness Connectors

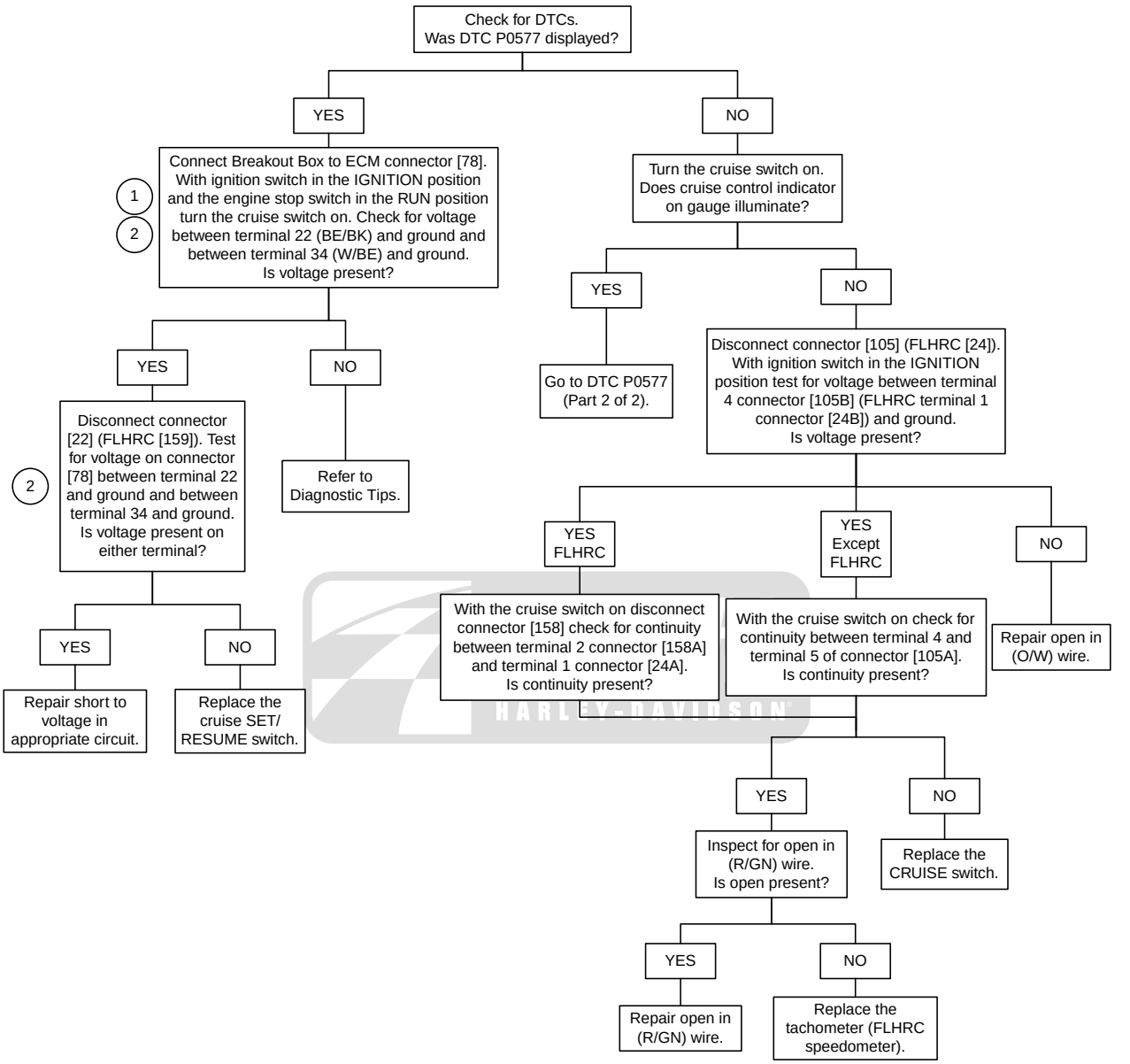
NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (Black)	Inner fairing - right fairing support bracket
		FLTR	16-place Molex (Black)	Inner fairing - below radio (right side)
[15]	Fairing harness	All	4-place Molex	Inner fairing - below radio
[20]	Console harness	FLHR	16-place Molex	Under seat

Table 4-52. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[22]	Right handlebar switches	FLHT/C	12-place Molex (Black)	Inner fairing - right fairing support bracket
		FLTR	12-place Molex (Black)	Inner fairing - right radio support bracket
		FLHR/C	6-place Molex	Inside headlamp nacelle - fork stem nut lock plate (right side)
[33]	Ignition switch	FLHT/C, FLTR	3-place Packard	Bottom of ignition switch housing
		FLHR/C	3-place Packard	Under console
[39]	Speedometer	FLHT/C	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Under bezel (back of speedometer)
		FLHR/C	12-place Packard	Under console (back of speedometer)
[78]	ECM	All	73-place Delphi	Under seat
[105]	Dash panel switches	FLHT/C/U/X	12-place Delphi	Inner fairing - beneath dash panel
		FLTR	12-place Packard	Inside instrument nacelle (under bezel)
[108]	Tachometer	FLHT/C	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)
[158]	Left handlebar switches (cruise control)	FLHRC (only)	3-place Molex	Inside headlamp nacelle
[159]	Right handlebar switches (cruise control)	FLHRC (only)	3-place Molex	Inside headlamp nacelle
[222]	Console ignition switch interconnect	FLHR/C	4-place Packard	Under seat

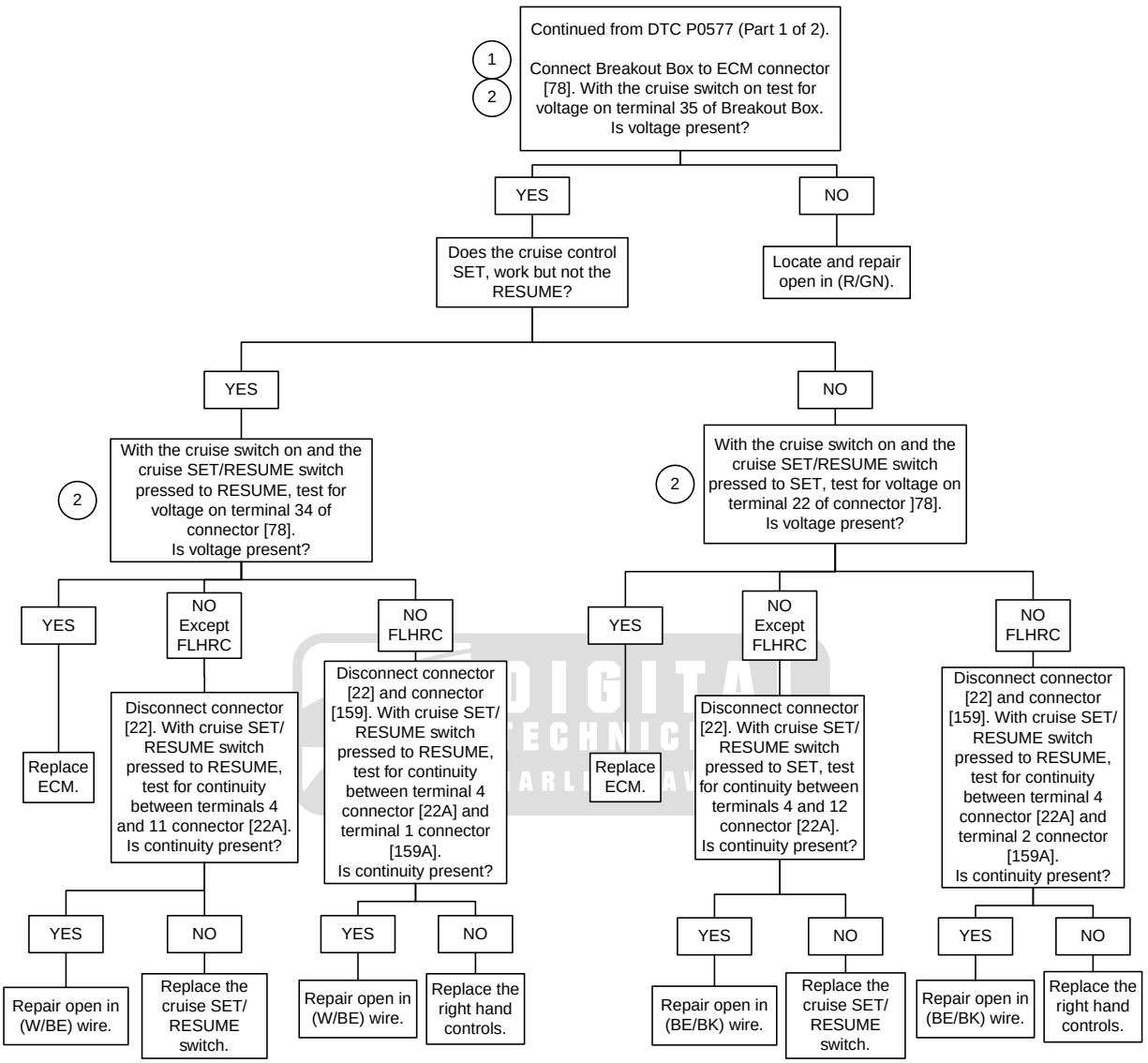
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DTC P0577 (Part 1 of 2)



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DTC P0577 (Part 2 of 2)



fc02207_en

CRUISE INOPERATIVE DIAGNOSTICS

Refer to Table 4-53. All diagnostics steps are listed in table format. Follow the numbered steps to test the system. Compare the system behavior CORRECT FUNCTION to INCORRECT FUNCTION columns and advance to the next step listed.

Table 4-53. Cruise Inoperative Diagnostics

NO.	ACTION	CORRECT FUNCTION	INCORRECT FUNCTION
1	Enter the diagnostic mode: RUN switch off, ignition switch at IGNITION. Hold the SET/RESUME switch at SET while turning the RUN switch on.	The green cruise lamp illuminates and remains on as long as the cruise SET/RESUME switch is held in the SET position. Continue to next step.	If the green cruise lamp remains illuminated after the switch is released then one of the switches or related wiring is shorted.
2	Push the SET/RESUME switch to RES(UME) and hold in this position.	The green cruise lamp illuminates and remains on as long as the SET/RESUME switch is held in the RES(UME) position. Continue to next step.	If the green cruise lamp does not illuminate at all, check for one or more of the following conditions: • RES(UME) switch not wired correctly. • Inoperative or pinched wire to RES(UME) switch.
3	Next, turn the throttle grip tightly closed to check the throttle roll-off command.	The green cruise lamp illuminates when the grip is closed (roll-off position), and extinguishes when the throttle grip returns to its free position. Continue to next step.	If the green cruise lamp does not illuminate at all, go to 4.43 DTC P2135, P2138.
4	Apply the front brake lever.	The green cruise lamp will illuminate and remain on until the brake lever is released. Continue to next step.	If the green cruise lamp does not illuminate at all, check for one or more of the following conditions: • Front brake switch not wired correctly. • Inoperative or pinched wire to front brake switch. • Front brake switch not working properly. See 4.26 DTC P0572.
5	Apply the rear brake pedal.	The green cruise lamp illuminates and remains on until the brake pedal is released. Continue to next step.	If the green cruise lamp does not illuminate at all, check for one or more of the following conditions: • Rear brake switch not wired correctly. • Inoperative or pinched wire to front brake switch. • Rear brake switch not working properly. See 4.26 DTC P0572.
6	To restart or repeat the diagnostic sequence, return to Step 1.		

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CRUISE DISENGAGE CAUSES

OFF Request

- ignition is off
- cruise switch is off (open)
- excessive battery voltage
- throttle position fault P0120 and P0220
- VSS fault P0501 and P0502
- cruise switch failure P0577
- TP sensor correlation error P2135
- flash checksum error P0605
- brake switch fault P0572
- TBW limited performance mode P1510

DISENGAGE Request

- cruise control is under target speed
- cruise control is over target speed
- cruise control is under target speed for excessive time
- cruise control is over target speed for excessive time
- brake is applied for debounce time
- twist grip roll-off
- both the SET/COAST and the RESUME/ACCELERATE switches are pressed at the same time
- engine run time minimum not met
- clutch lever is pulled in (declutched)
- excessive vehicle acceleration rate
- vehicle speed exceeds maximum cruise speed limit
- vehicle speed below minimum cruise speed limit
- engine speed exceeds maximum engine speed limit
- engine speed below minimum engine speed limit
- excessive engine speed acceleration
- vehicle speed governing active
- transmission is in too low of a gear or in (N)

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DTC P0603, P0605 4.28

GENERAL

ECM Failure

Refer to Table 4-54. The DTCs listed indicate a failure which requires replacement of the ECM. See the service manual for replacement information.

NOTE

After replacing ECM perform password learning procedure and clear codes.

Table 4-54. Code Description

DTC	DESCRIPTION
P0603	ECM EEPROM error
P0605	ECM flash error

DIAGNOSTICS

These codes are set under two conditions.

- If DTC P0603 or P0605 occur during normal operation, replace ECM. Program and learn password.
- If DTC P0603 or P0605 occur during or after programming, perform the tests that follow.

DTC P0603

1. Clear DTCs.
2. Power down the vehicle. Wait 10 seconds.
3. Turn ignition switch to IGNITION.
4. Replace ECM if code reappears.

DTC P0605

1. Clear DTCs.
2. Power down the vehicle.
3. Attempt to program ECM using correct calibration.
4. Restart vehicle. If code reappears, replace ECM.

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DTC P0641, P0651 4.29

GENERAL

See Figure 4-66. The ECM controls 5 volt power from terminal 50 for Vref-1 and terminal 68 for Vref-2. The ECM provides a common ground point for components through terminal 61 for Vref-1 and terminal 62 for Vref-2. The ECM monitors voltage on the 5V reference circuits and sets the DTCs below if the voltage goes out of range. Refer to Table 4-55.

- DTC P0641 is displayed when Vref-1 voltage is out of range. The 5V sensor power-1 (Vref-1) circuit supplies the TCA, VSS, jiffy stand sensor, and sensor 2 of the TGS with a 5V reference signal.
- DTC P0651 is displayed when Vref-2 is out of range. The 5V sensor power-2 (Vref-2) circuit supplies the TMAP sensor, and sensor 1 of the TGS with a 5V reference signal.

Table 4-55. Code Description

DTC	DESCRIPTION
P0641	5V Vref-1 out of range
P0651	5V Vref-2 out of range

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Tips

- An intermittent may be caused by poor connection, rubbed through wire insulation or an inoperative wire inside the insulation.
- **Poor connection**: Inspect component and harness connectors for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damage to the wires or harnesses.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) to the ECM and ECM harness. See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes, socket probes and patch cords.

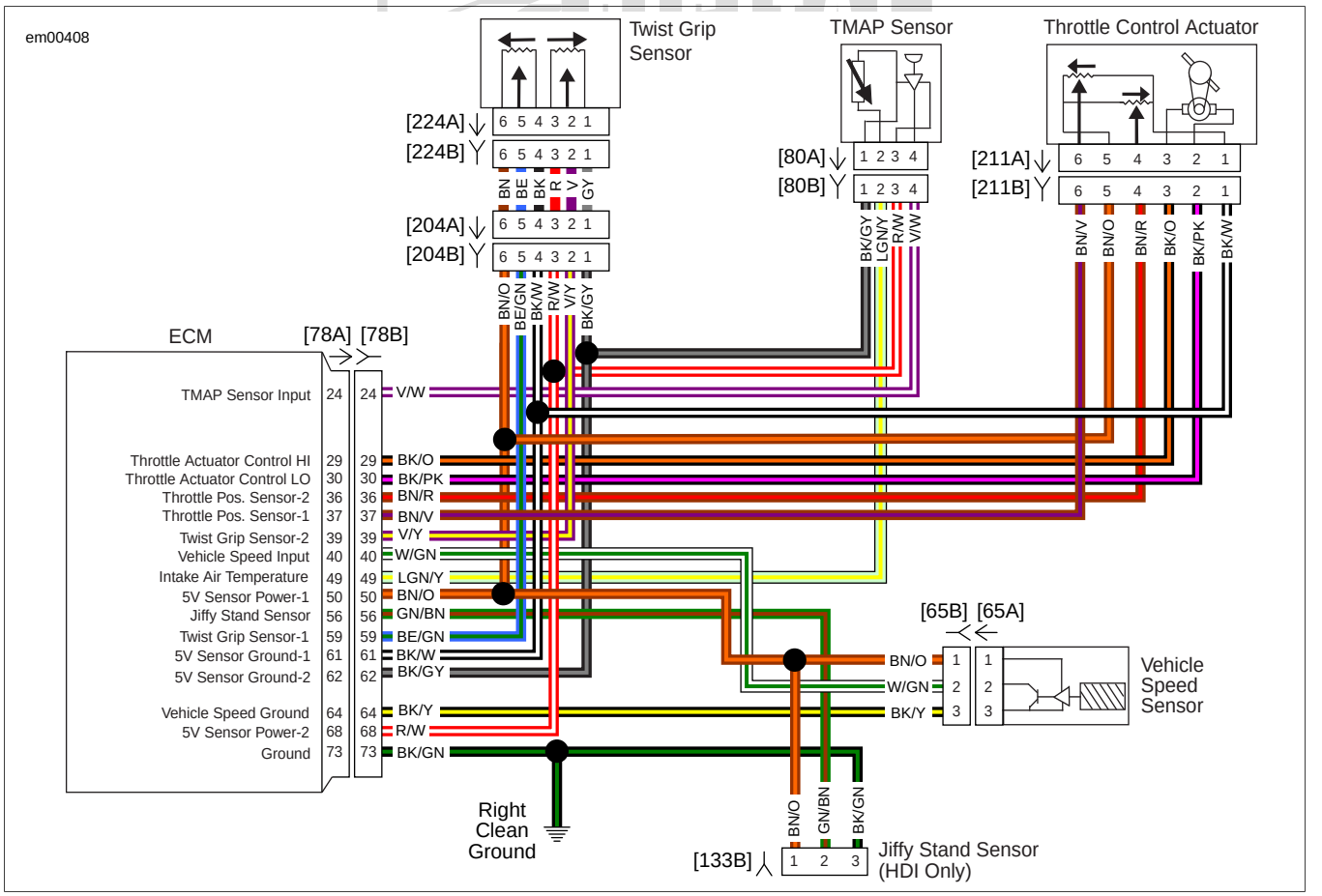


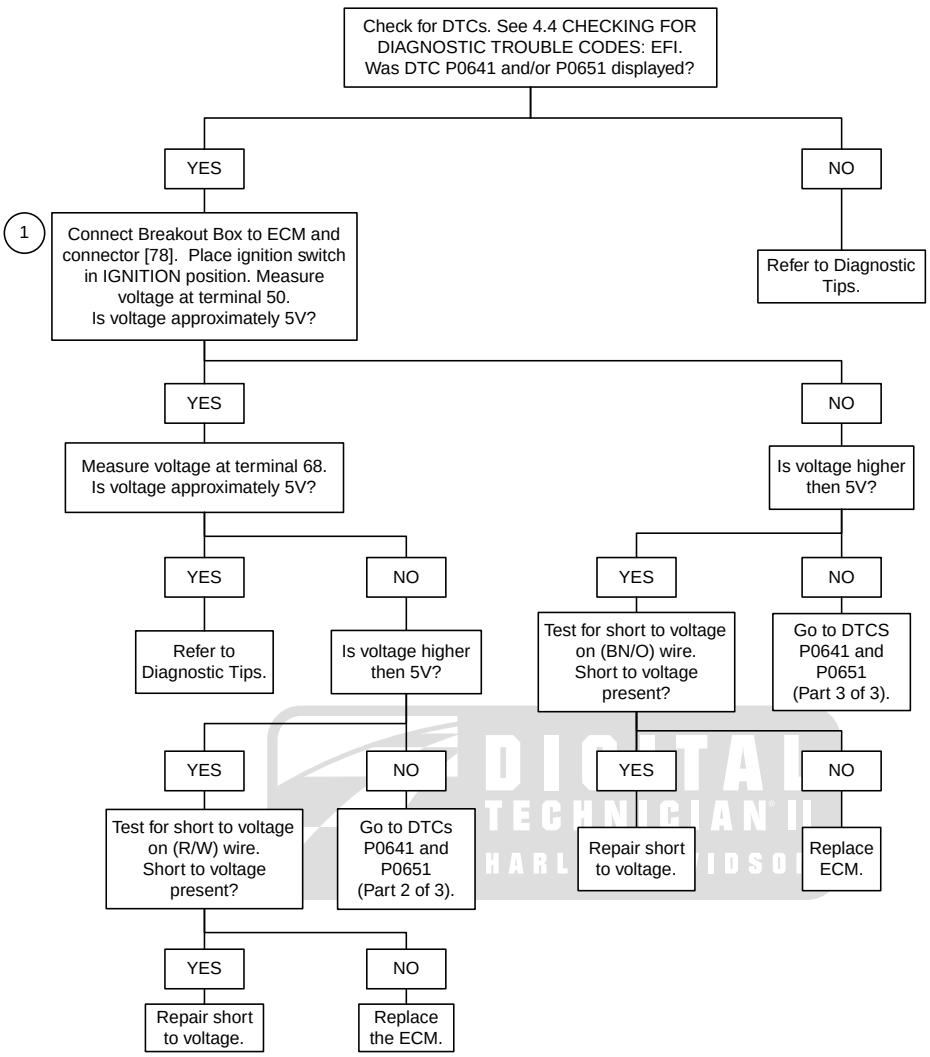
Figure 4-66. 5-Volt Vref-1 and Vref-2 Circuit

Table 4-56. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[65]	VSS	All	3-place Delphi	Top of transmission case (under starter)
[78]	ECM	All	73-place Delphi	Under seat
[80]	TMAP sensor	All	4-place Bosch	Top of induction module (vehicle right side)
[133]	Jiffy stand sensor	All	3-place Molex	Rear of front lower frame crossmember
[204]	TGS harness	FLHT/C/U/X	6-place Molex	Inner fairing (right of fairing support bracket)
		FLTR	6-place Molex	Inner fairing - right side below radio
		FLHR	6-place Molex	Inside headlamp nacelle, fork stem nut lockplate
[211]	TCA	All	6-place Molex	Side of induction module (vehicle right side)
[224]	TGS	All	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)

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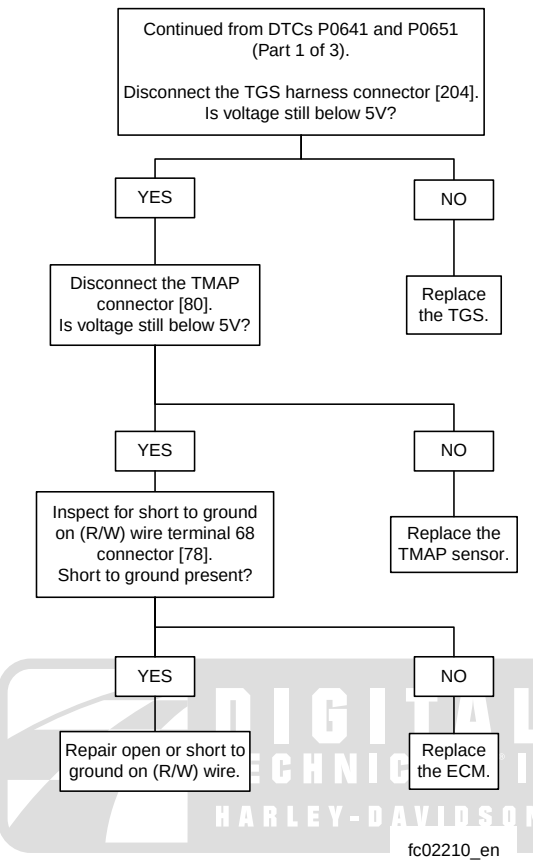
DTCs P0641 and P0651 (Part 1 of 3)



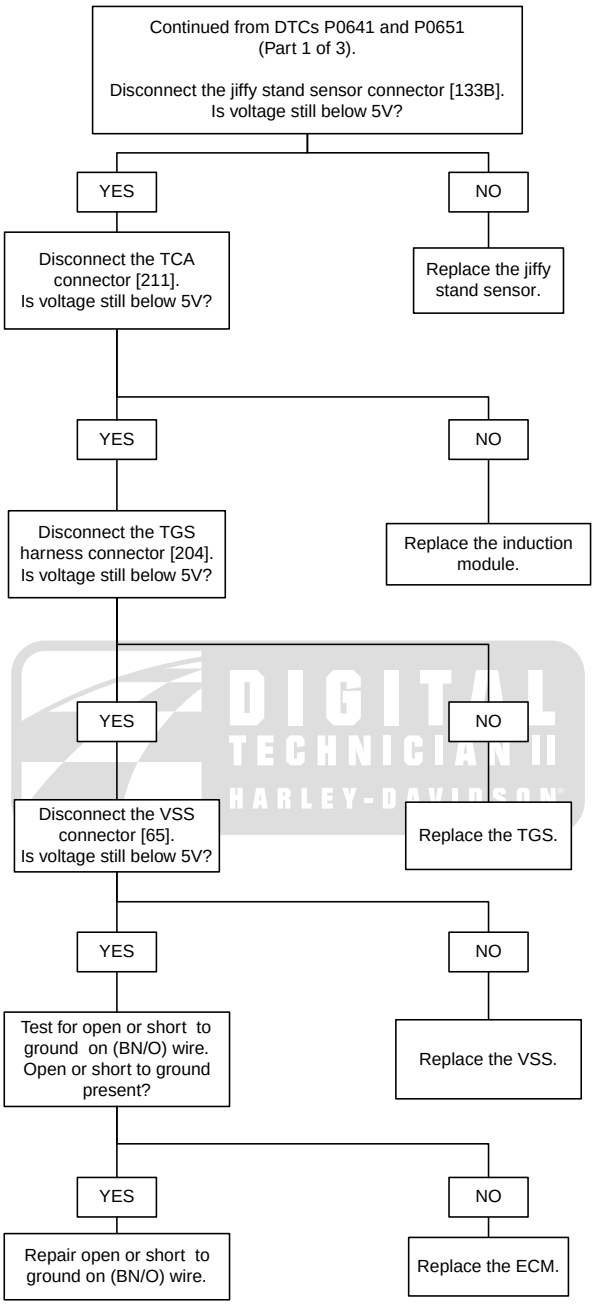
Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTCs P0641 and P0651 (Part 2 of 3)



DTCs P0641 and P0651 (Part 3 of 3)



fc02211_en

DTC P1009, P1010 4.30

GENERAL

Password Problem

The ECM, TSM/TSSM/HFSM and speedometer exchange passwords during operation. An incorrect password or missing password will set a diagnostic code.

NOTE

If the TSM/TSSM/HFSM is not connected to the wiring harness, the vehicle will not start.

Table 4-57. Code Description

DTC	DESCRIPTION
P1009	Incorrect password
P1010	Missing password

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. DTC P1009 may be set if a recent ECM or TSM/TSSM/HFSM replacement did not follow the correct password assignment procedure. See 3.26 TSM/HFSM: PASSWORD LEARN for details.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), black socket probes and patch cord.
3. Connect BREAKOUT BOX (Part No. HD-48637) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
4. Historic codes DTC U1300 or DTC U1301 would also have been set. Clear codes.
5. See the service manual for TSM/TSSM/HFSM replacement. See 3.26 TSM/HFSM: PASSWORD LEARN, Password Learning for the password learning procedure.

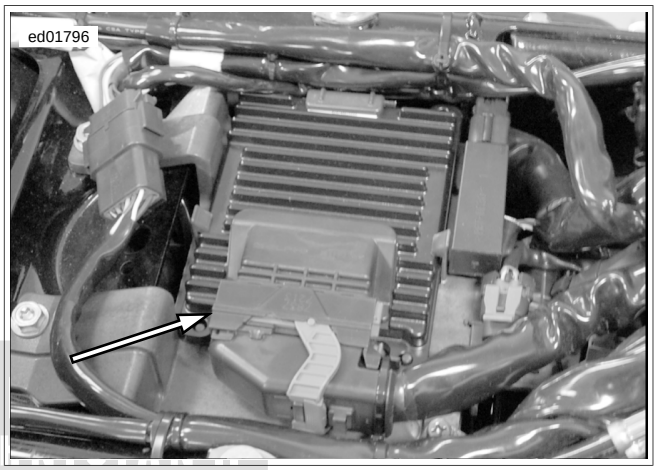


Figure 4-67. Electronic Control Module (ECM)

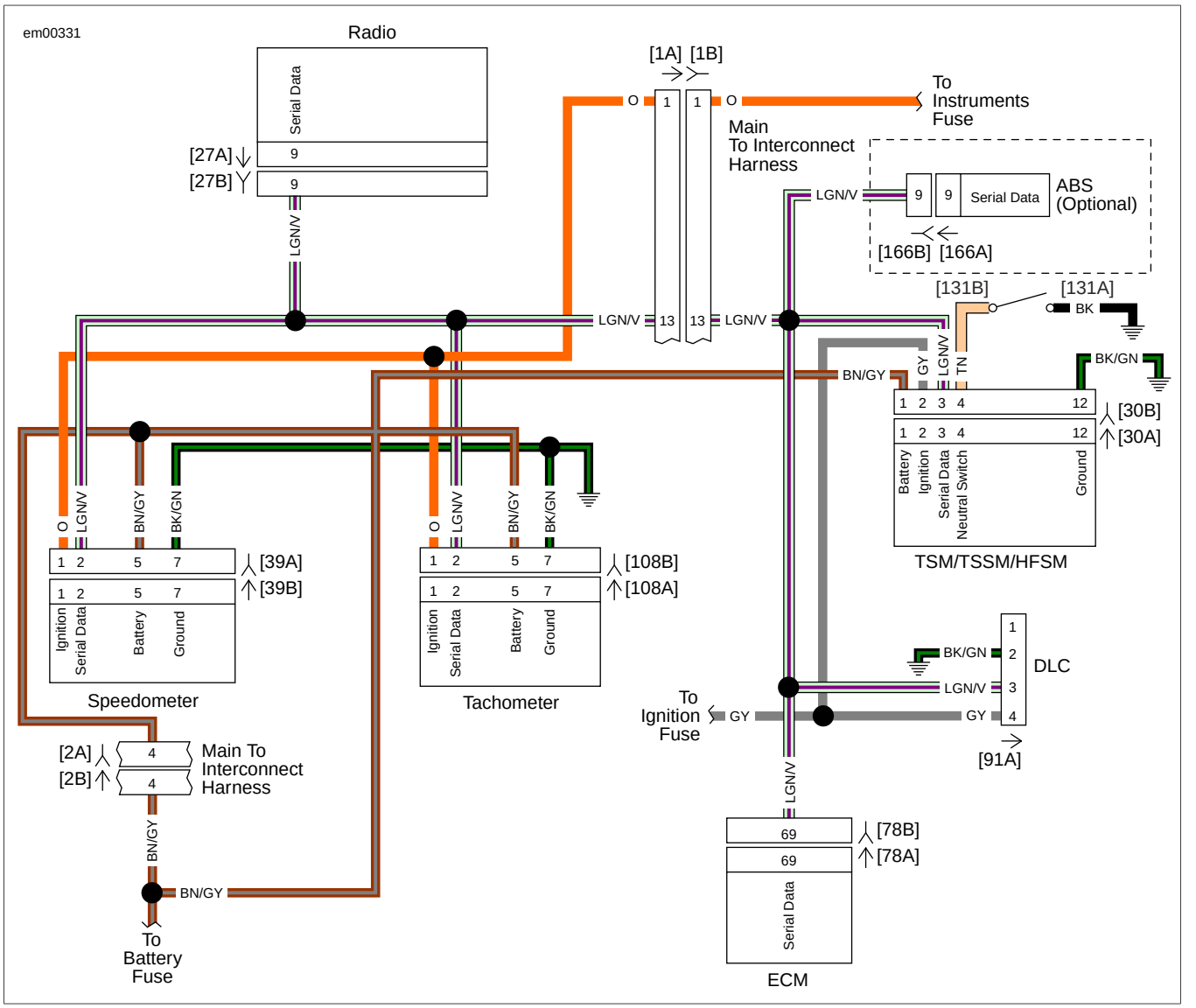


Figure 4-68. Serial Data Circuit (FLHX, FLHT/C/U, FLTR)

Table 4-58. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (black)	Inner fairing - right side (below radio)
[2]	Main to interconnect harness	All	12-place Molex (gray)	Inner fairing - left radio support bracket
[27]	Radio	All	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[30]	TSM/TSSM/HFSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHT/C	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
[78]	ECM	All	73-place Delphi	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover

Table 4-58. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[108]	Tachometer	FLHT/C	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)
[166]	ABS module	All	20-place Molex	Under right side cover

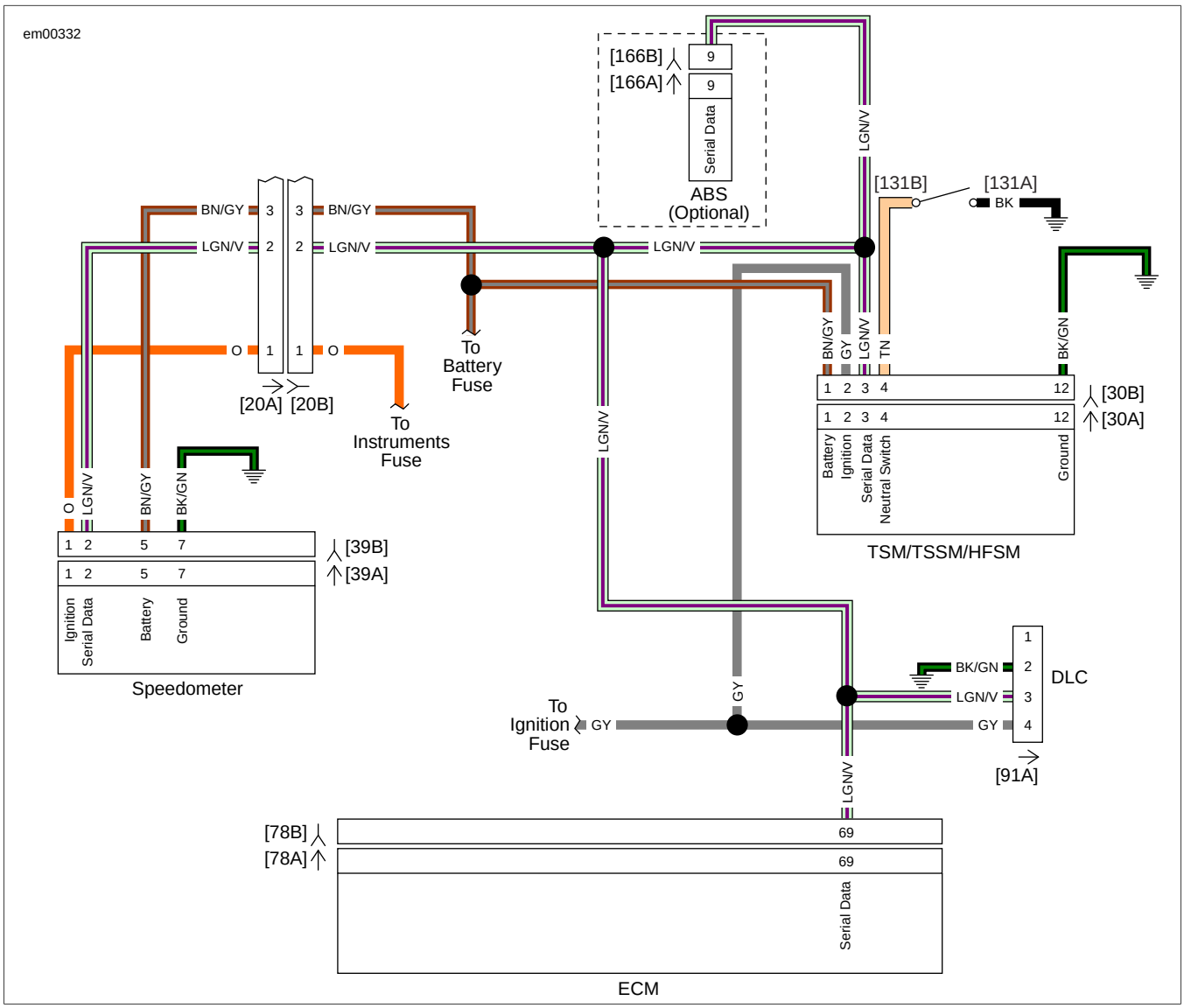


Figure 4-69. Serial Data Circuit (FLHR/C)

Table 4-59. Wire Harness Connectors

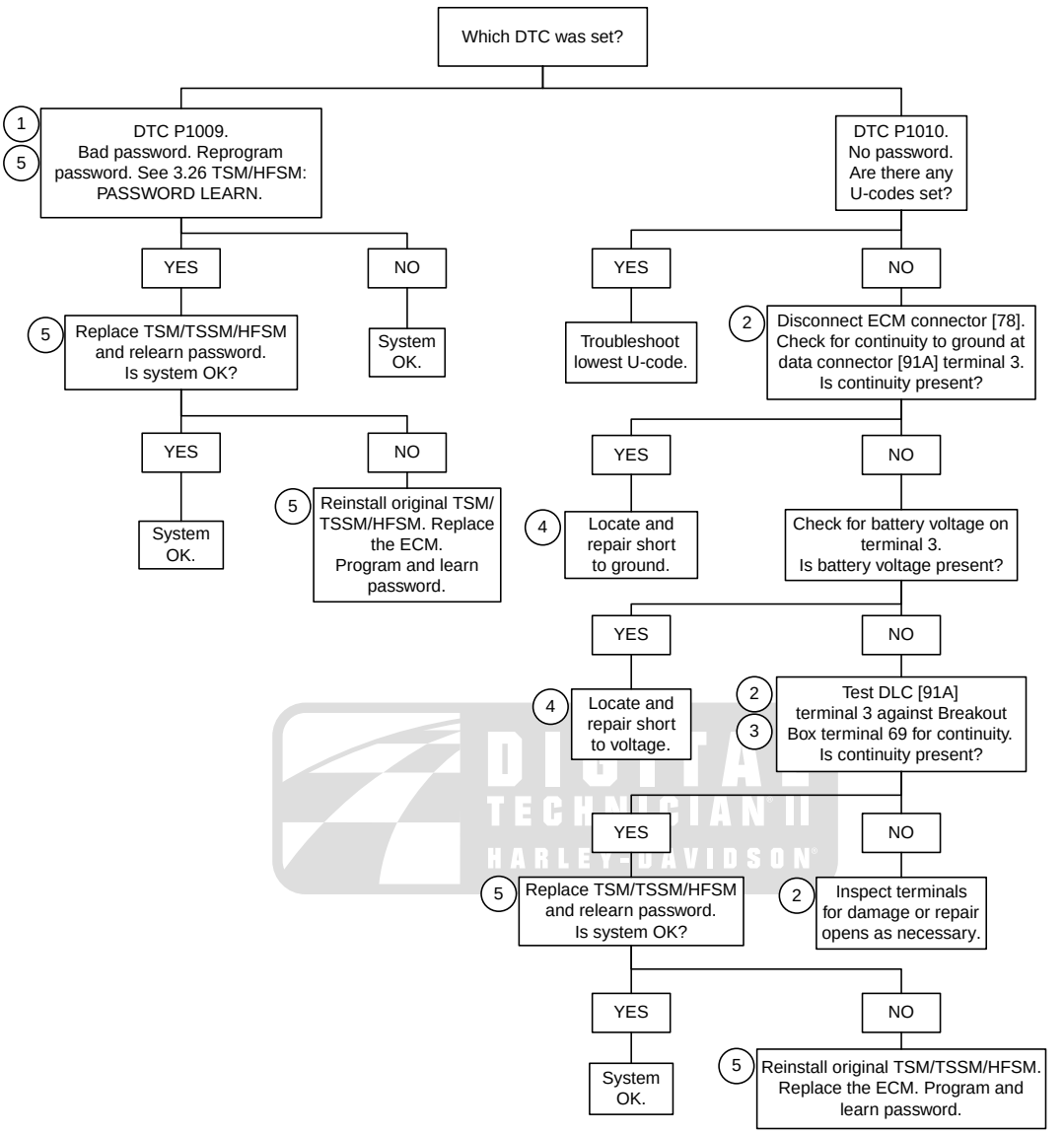
NO.	DESCRIPTION	TYPE	LOCATION
[30]	TSM/TSSM/HFSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Packard	Under console (back of speedometer)
[78]	ECM	73-place Delphi	Under seat

Table 4-59. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[91]	DLC	4-place Deutsch	Under left side cover
[166]	ABS module	20-place Molex	Under right side cover

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DTCs P1009 and P1010



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTC P1270 4.31

GENERAL

TGS2 Validation

Within the ECM, there are two independent Analog/Digital (A/D) converter modules used to validate the input of Twist Grip Sensor 2 (TGS2). TGS2 inputs are sent into both converter modules and if the output of the two readings are not within the designated value of each other, for a specified time, then DTC P1270 fault is initiated.

Unless the ECM has a poor or intermittent connection, DTC P1270 indicates the ECM is defective and requires replacement. See the service manual for replacement information.

NOTE

After replacing the ECM, perform password learning procedure and clear codes.

Table 4-60. Code Description

DTC	DESCRIPTION
P1270	TGS2 validation error

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-48637	BREAKOUT BOX

Diagnostic Tips

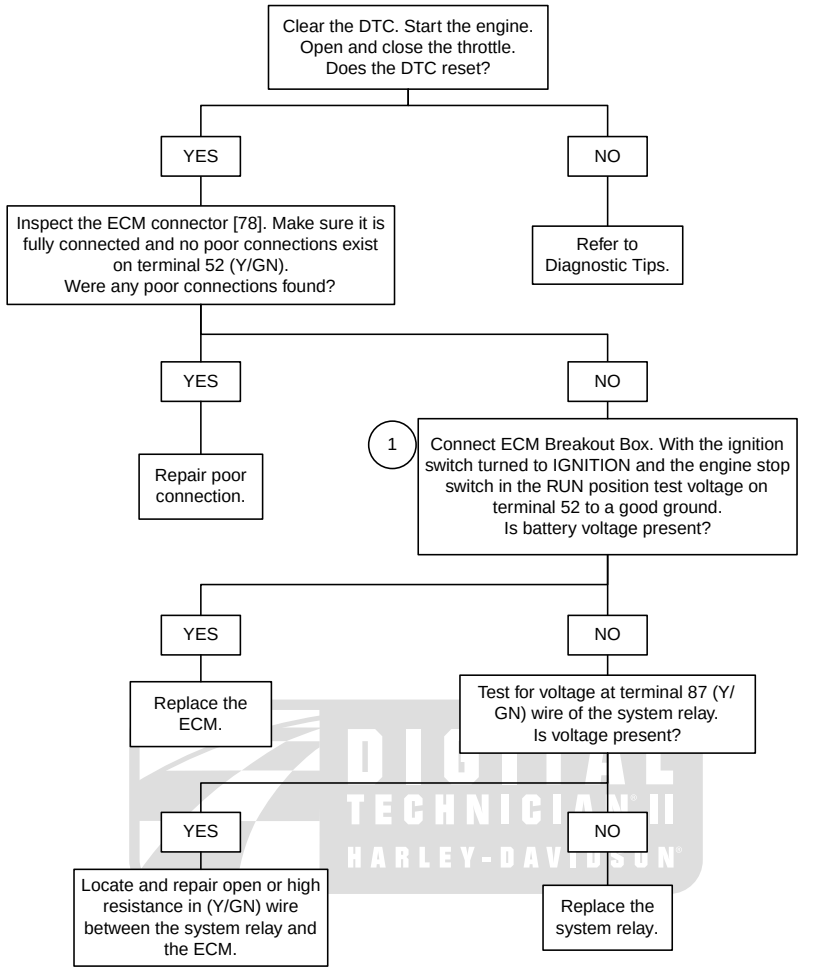
- An intermittent may be caused by poor connection, rubbed through wire insulation or a wire broken inside the insulation.
- **Poor connection**: Inspect component and harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harnesses.

Diagnostic Notes

Connect BREAKOUT BOX (Part No. HD-48637) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC P1270



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTC P1351, P1352, P1354, P1355 4.32

GENERAL

Ignition Coil

Ignition coil DTCs will set if the ignition coil primary voltage is out of range. This could occur if there is an open coil or loss of power to the coil. If front and rear DTCs are set simultaneously, it is likely a coil power failure or a coil failure.

See Figure 4-70. The coil receives power from the system relay at the same time that the fuel pump and injectors are activated. The system relay is active for the first 2 seconds after the ignition switch is turned to IGNITION and then shuts off until RPM is detected from the CKP sensor, at which time it is reactivated. The ECM is responsible for turning on the system relay by providing the ground to activate the relay, which in turn powers the coil.

Table 4-61. Code Description

DTC	DESCRIPTION
P1351	Front ignition coil open/low
P1352	Front ignition coil high/shorted
P1354	Rear ignition coil open/low
P1355	Rear ignition coil high/shorted

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-34730-2C	FUEL INJECTOR TEST LAMP
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-44687	IGNITION COIL CIRCUIT TEST ADAPTER
HD-48637	BREAKOUT BOX

Diagnostic Notes

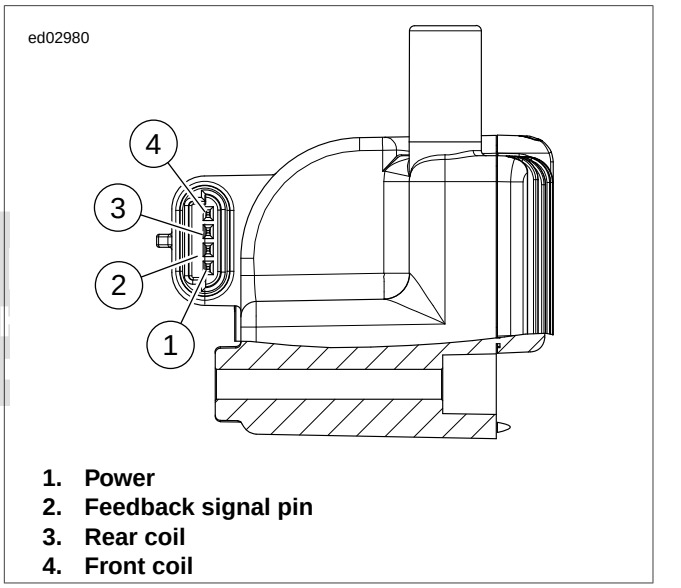
Each reference number below correlates to a circled number on the flowchart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probes and patch cord.

NOTE

Gently connect test lamp to connector [83B]. Forcefully inserting test lamp will result in ignition connector terminal damage.

2. Plug IGNITION COIL CIRCUIT TEST ADAPTER (Part No. HD-44687) and FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C) into BREAKOUT BOX (Part No. HD-48637). Note that cranking the engine with test lamp in place of the ignition coil can sometimes cause DTC P1351, P1352, P1354 or P1355. This condition is normal and does not by itself indicate a malfunction. DTCs must be cleared if this condition occurs.
3. Connect BREAKOUT BOX (Part No. HD-48637) between EFI wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple socket probes and patch cord.



1. **Power**
2. **Feedback signal pin**
3. **Rear coil**
4. **Front coil**

Figure 4-70. Ignition Coil Connector Terminals

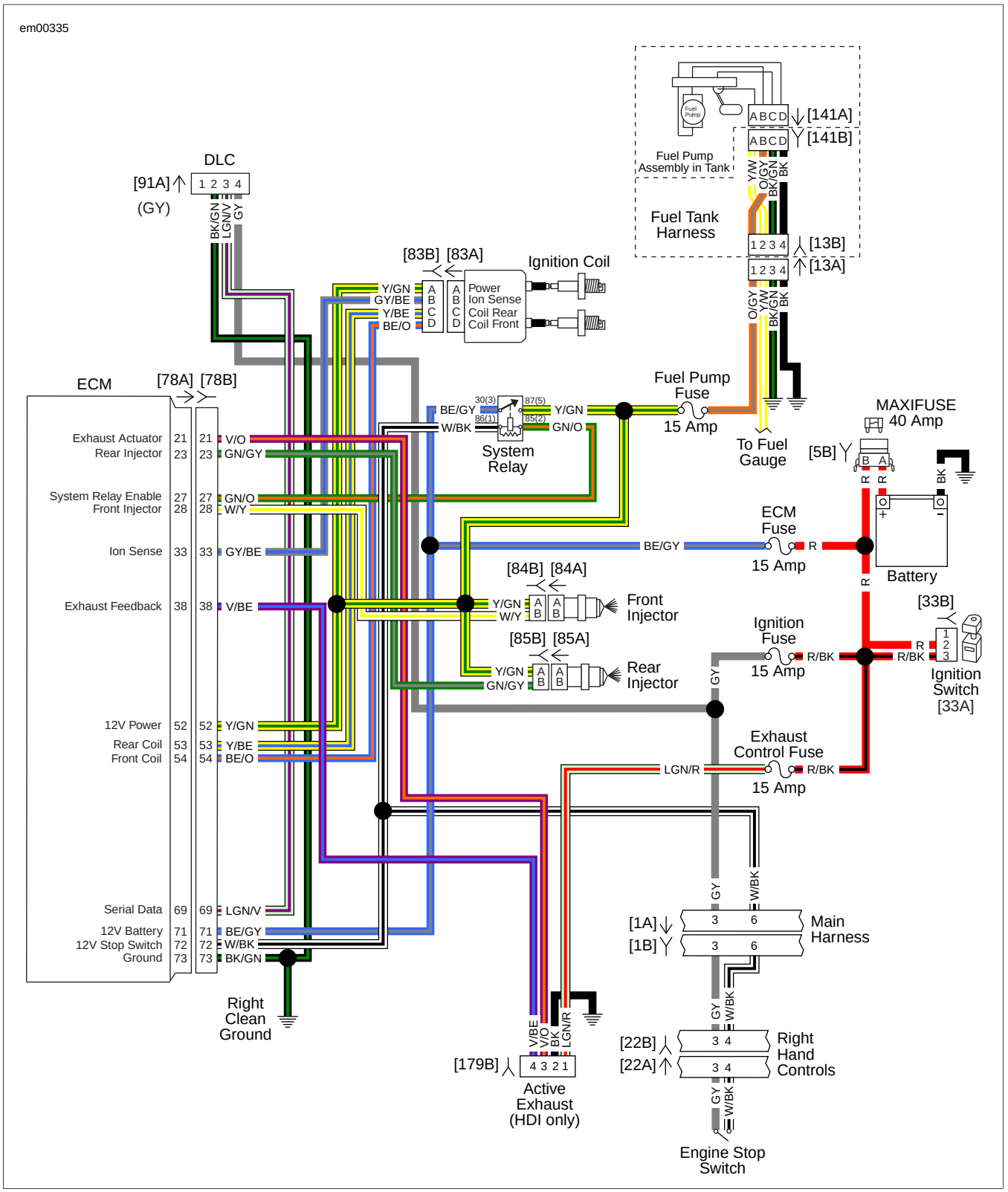


Figure 4-71. Ignition Coil Circuit Diagram (FLHX, FLHT/C/U, FLTR)

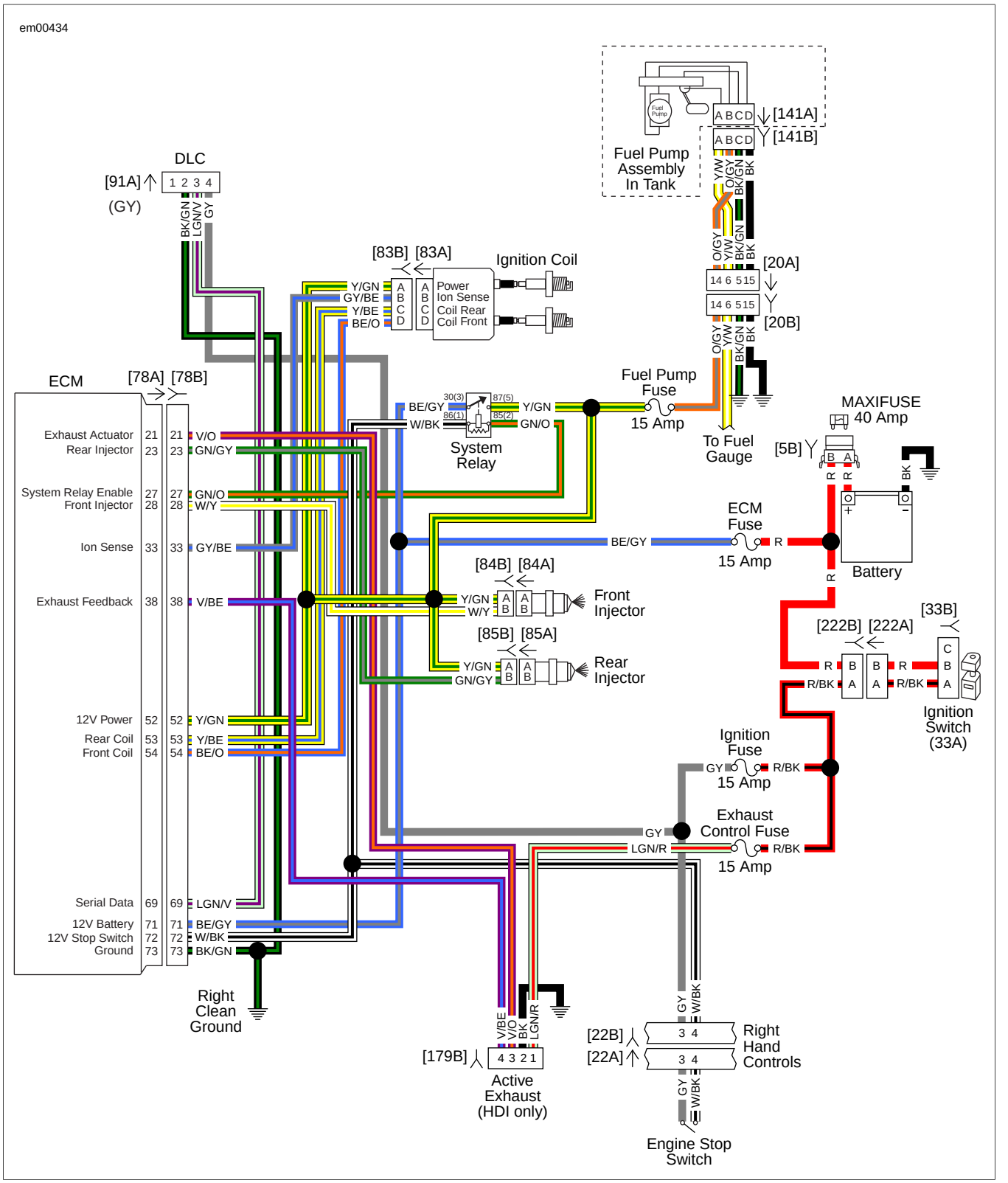


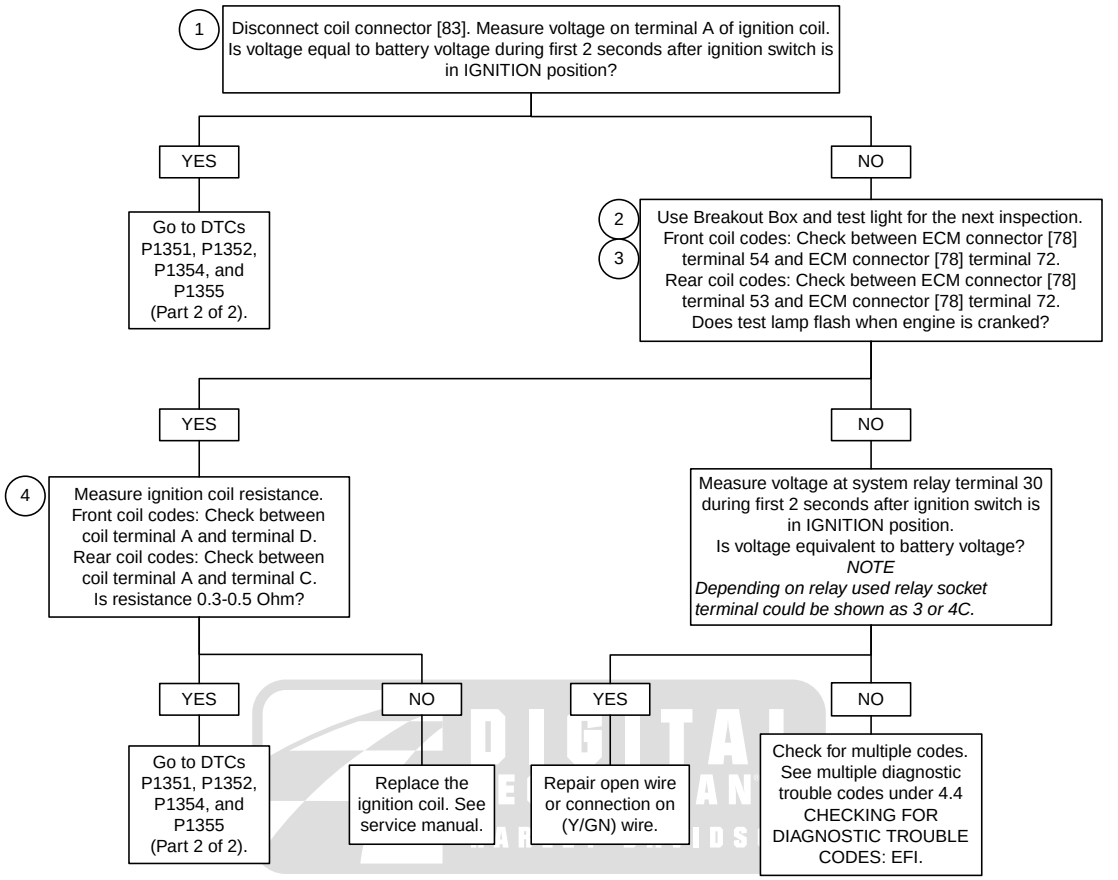
Figure 4-72. EFI Circuit (FLHR/C)

Table 4-62. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side below radio
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[13]	Fuel tank harness	All	4-place Multilock	Behind fuel tank (under seat)
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[22]	Right handlebar switches	FLHR/C	6-place Molex (Black)	Inside headlamp nacelle fork stem nut lock plate (right side)
		FLHT/C/U/X	12-place Molex (Black)	Inner fairing - right fairing support bracket
		FLTR	12-place Molex (Black)	Inner fairing - left fairing support bracket
[33]	Ignition switch	FLHT/C/U FLTR	3-place Packard	Bottom of ignition switch housing
		FLHR/C	3-place Packard	Under console
[78]	ECM	All	73-place Delphi	Under seat
[83]	Ignition coil	All	4-place Delphi	Bottom front of battery tray
[84]	Front injector	All	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	All	2-place Delphi	Below fuel tank (left side)
[91]	DLC	All	4-place Deutsch	Under left side cover
[141]	Fuel pump and fuel level sender	FLHX FLHT/C/U	4-place Packard	Under console on top of fuel tank canopy
		FLHR/C FLTR	4-place Packard	Top of canopy (under console)
[179]	Active exhaust actuator	All	5-place Amp (Tyco)	Domestic (not used)
				HDI: Under right side cover
[222]	Console ignition switch interconnect	FLHR/C	4-place Packard	Under seat

DIGITAL TECHNICIAN

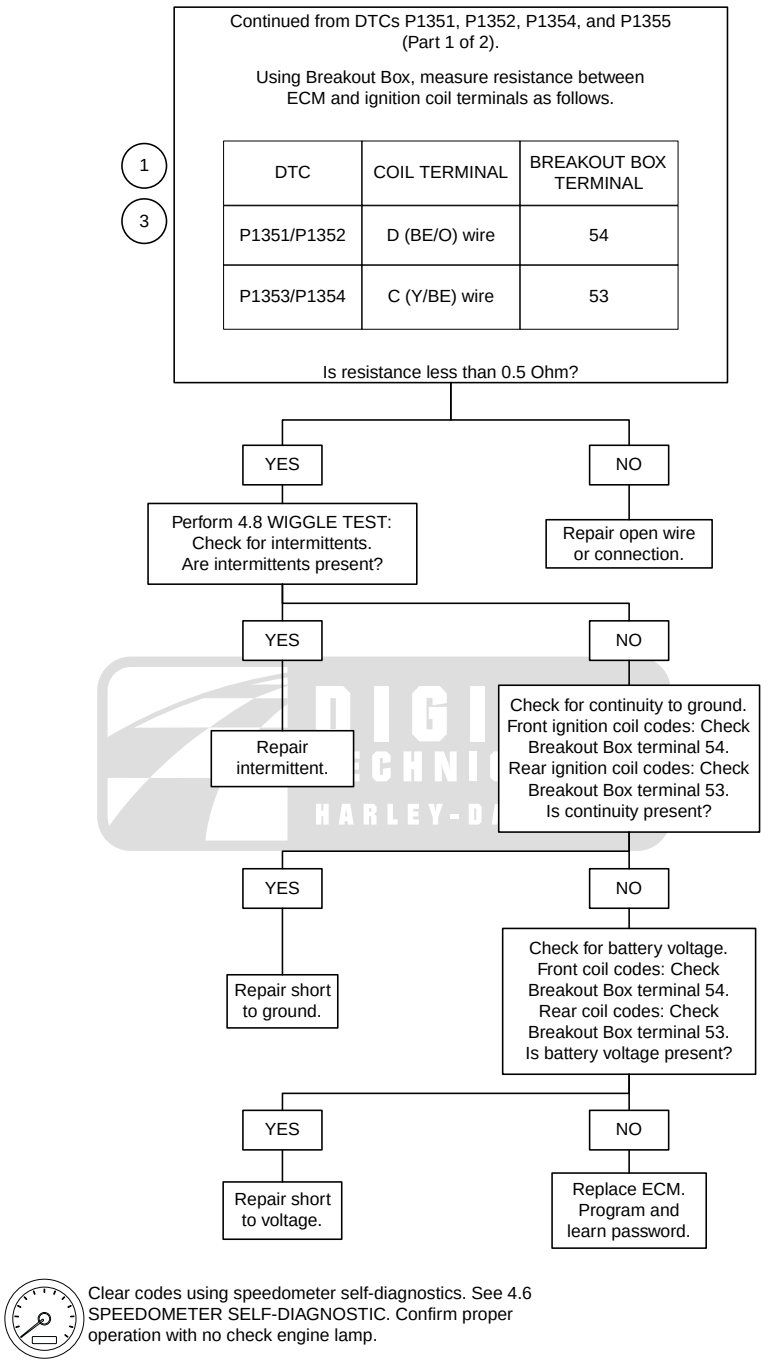
DTCs P1351, P1352, P1354, and P1355 (Part 1 of 2)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

fc02144_en

DTCs P1351, P1352, P1354, and P1355 (Part 2 of 2)



DTC P1475, P1477, P1478 4.33

GENERAL

Active Exhaust Actuator (HDI Models)

The active exhaust system uses an actuator valve located in the rear exhaust pipe which is connected to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance. The active exhaust is protected by the 15 Amp exhaust control fuse.

Table 4-63. Code Description

DTC	DESCRIPTION
P1475	Exhaust actuation position error
P1477	Exhaust actuator open/low
P1478	Exhaust actuator shorted

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord.

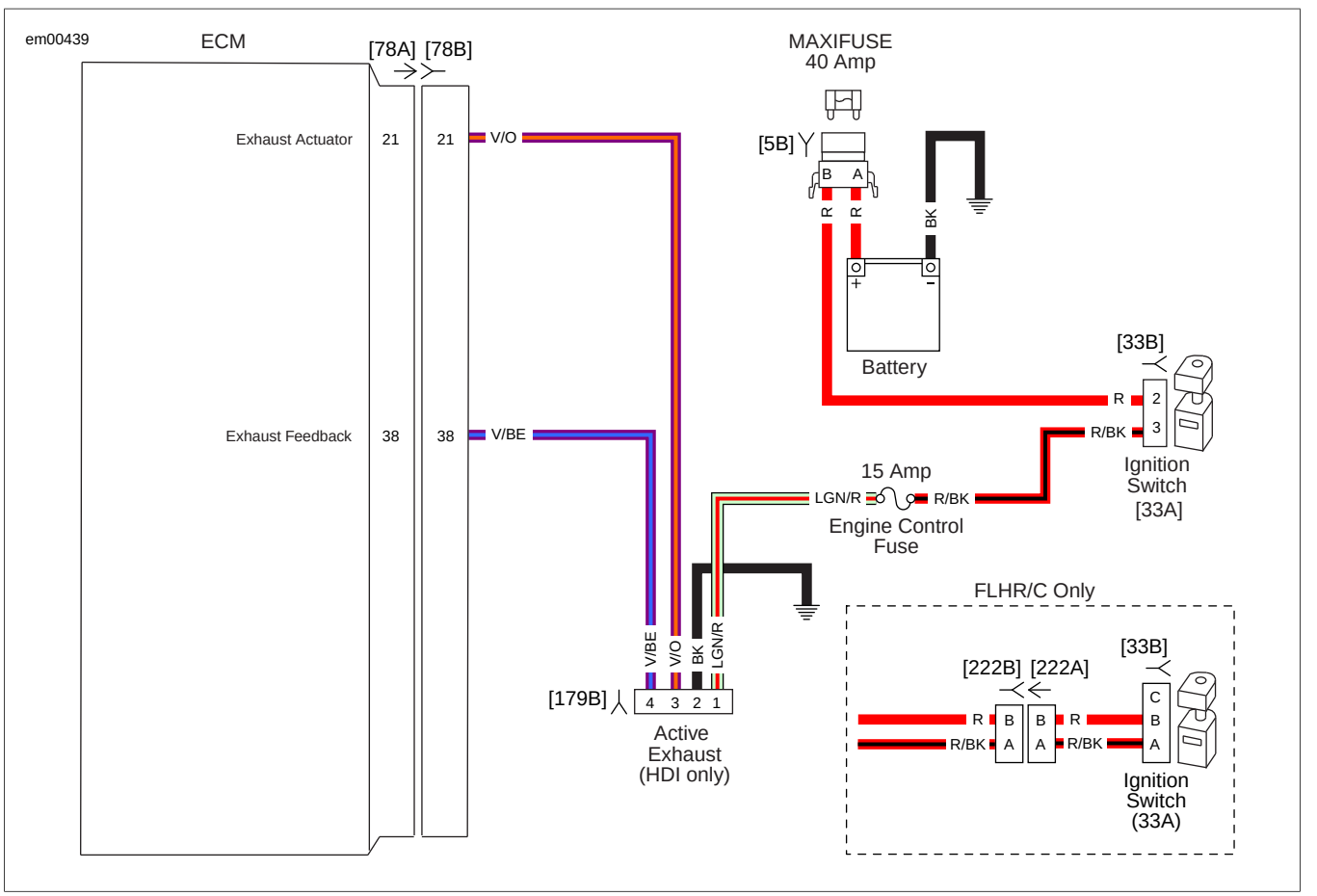


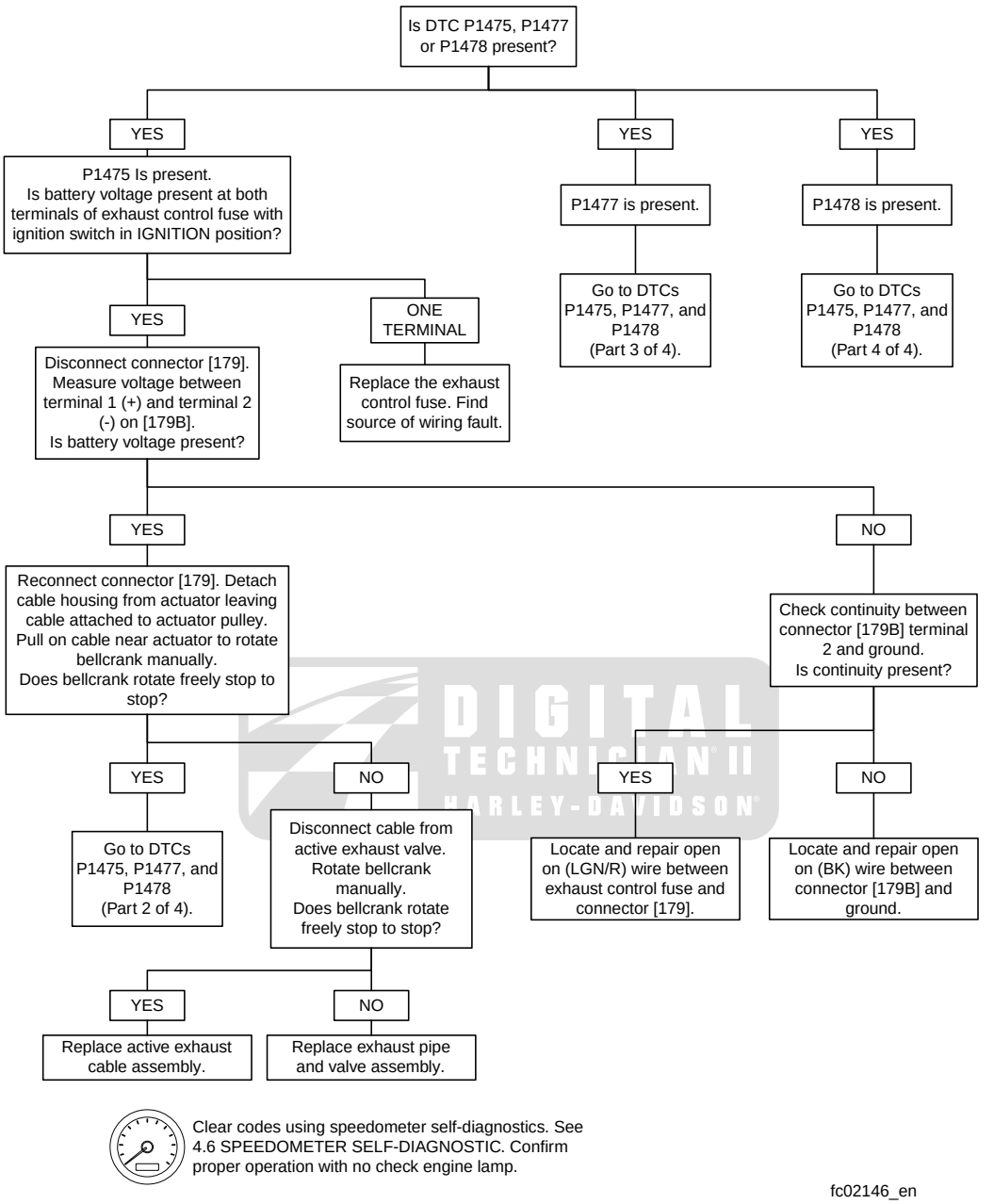
Figure 4-73. Active Exhaust Actuator Circuit (typical)

Table 4-64. Wire Harness Connectors

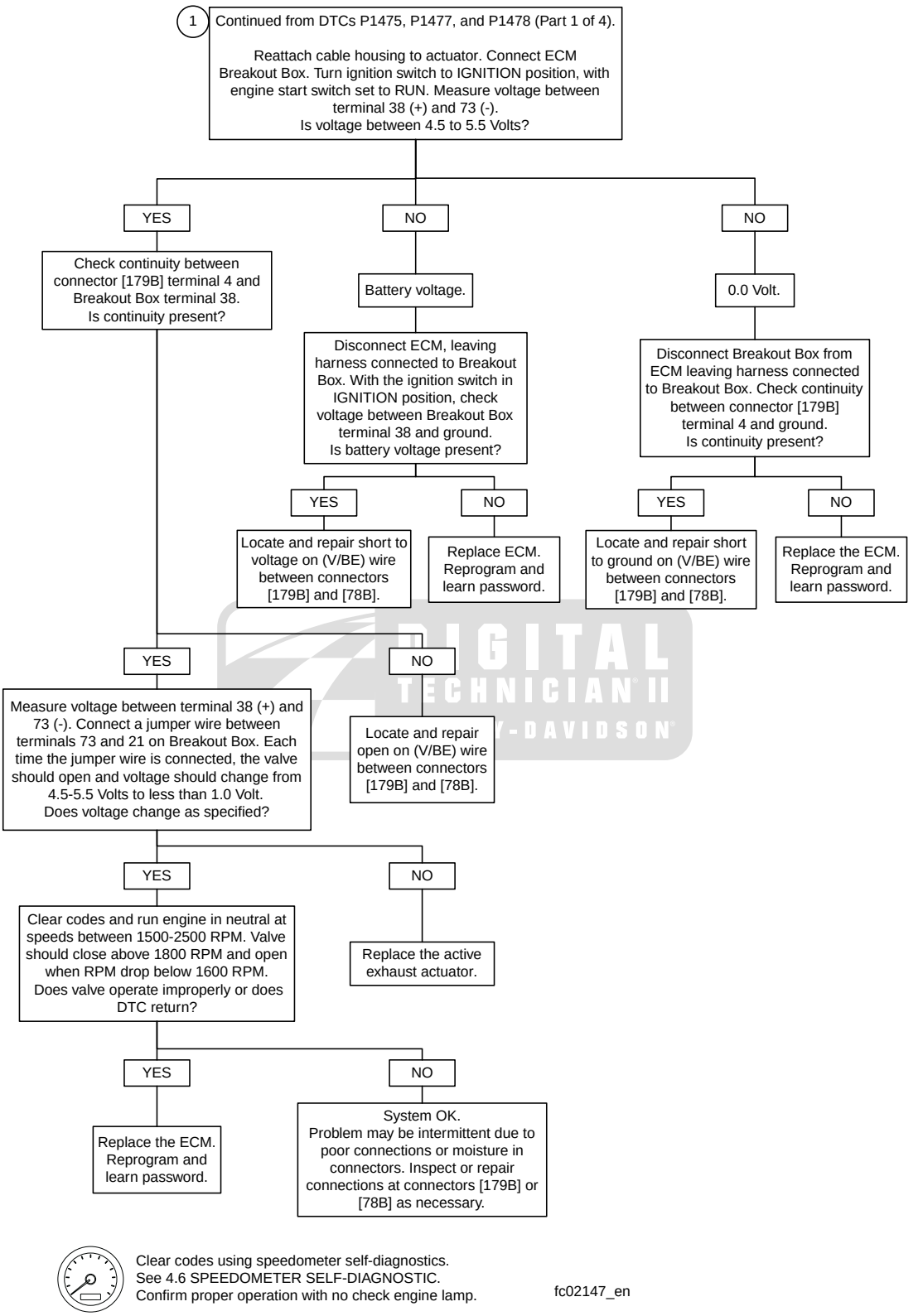
NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[33]	Ignition switch	FLHT/C/U/X	3-place Packard	Bottom of ignition switch housing)
		FLHR	3-place Packard	Under console
[78]	ECM	All	73-place Delphi	Under seat
[179]	Active exhaust actuator	All	5-place Amp (Tyco)	Under right side cover
[222]	Console ignition switch interconnect	FLHR/C	4-place Packard	Under seat

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

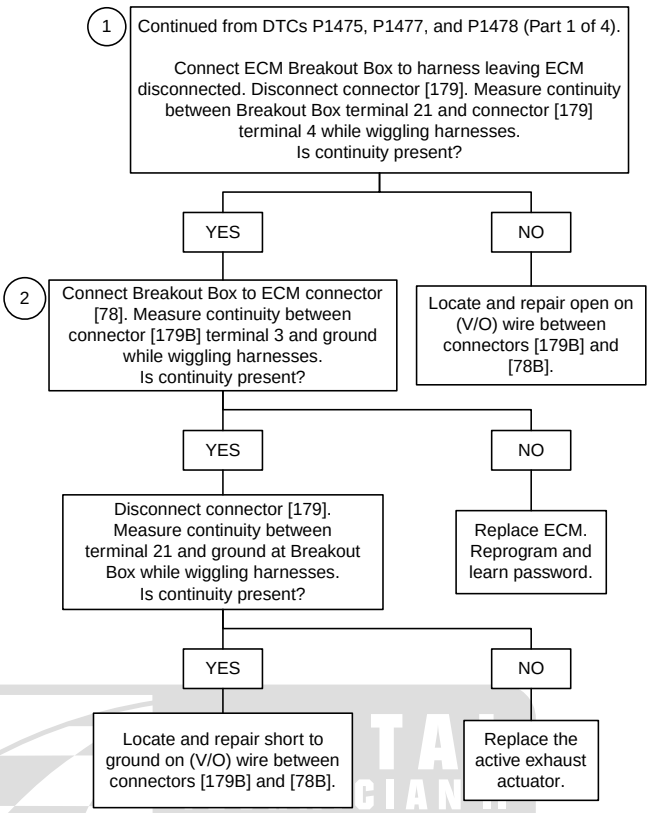
DTCs P1475, P1477, and P1478 (Part 1 of 4)



DTCs P1475, P1477, and P1478 (Part 2 of 4)



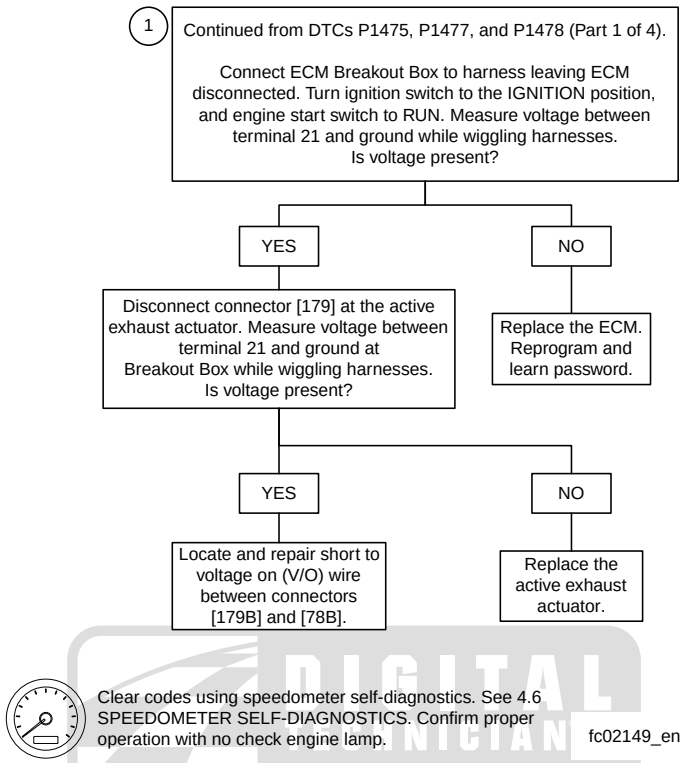
DTCs P1475, P1477, and P1478 (Part 3 of 4)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTCs P1475, P1477, and P1478 (Part 4 of 4)



DIGITAL TECHNICIAN HARLEY-DAVIDSON

DTC P1501, P1502 4.34

GENERAL

Jiffy Stand Sensor (HDI and FLHTP)

The jiffy stand sensor uses a Hall-effect sensor to monitor jiffy stand position. When the jiffy stand is fully retracted the sensor picks up the presence of the metal tab mounted to the jiffy stand. The metal tab is moved away from the sensor as the jiffy stand is extended. When the jiffy stand is extended the engine starts and runs only if the TSM/TSSM/HFSM determines the transmission is in neutral, otherwise the engine starts and stalls. This is done by monitoring the neutral switch input to the TSM/TSSM/HFSM and communicating that input over the serial data circuit to the ECM.

The jiffy stand sensor also has a fail enable mode. This mode allows the engine to start and run if the system recognizes a problem with the jiffy stand sensor circuit. If a problem exists or if the transmission is put in gear with the jiffy stand extended the odometer displays "SIdE Stand". DTC P1501 or P1502 will set if the jiffy stand sensor circuits are out of range.

The jiffy stand sensor is powered and monitored by the ECM. ECM terminal 50 supplies the 5V reference to the jiffy stand sensor connector [133] terminal 1. See Figure 4-74. The jiffy stand sensor terminal 2 sends a signal back to the ECM terminal 56. This signal is how the ECM determines if the jiffy stand is retracted or extended. The jiffy stand sensor terminal 3 is grounded through the ECM terminal 73.

NOTE

The ECM supplies not only the jiffy stand sensor but also the VSS and the TCA with a 5V reference signal from terminal 50.

Table 4-65. Code Description

DTC	DESCRIPTION
P1501	Jiffy Stand Sensor low
P1502	Jiffy Stand Sensor high

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. See the service manual for TSM/TSSM/HFSM replacement. See 3.26 TSM/HFSM: PASSWORD LEARN for the password learning procedure.
2. Unplug the neutral switch connector [131]. Using a DVOM test for continuity between terminals A and B of the neutral switch. When the transmission is in neutral, continuity should exist. When the transmission is in gear, there should not be continuity through the neutral switch.
3. When the jiffy stand is retracted, voltage on terminal 56 should be approximately 1.65-2.47 Volts. When the jiffy stand is extended, the voltage on terminal 56 should be approximately 2.94-4.41 Volts.
4. Connect BREAKOUT BOX (Part No. HD-48637) to the ECM and ECM harness. See 4.7 BREAKOUT BOX: EFI.
5. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes, socket probes and patch cords.
6. Follow flowchart to determine necessary component replacement. Replace parts according to service manual.

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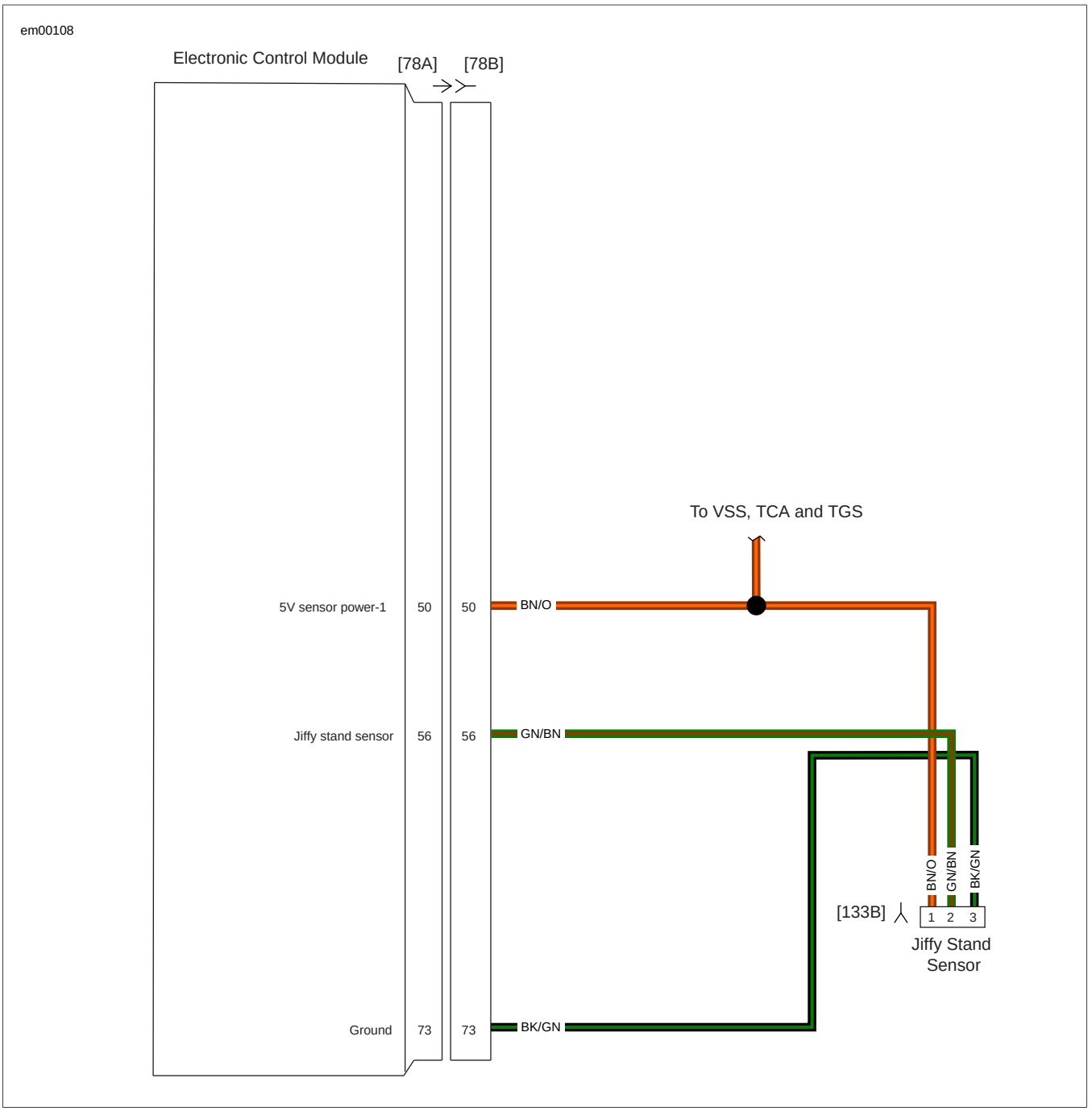
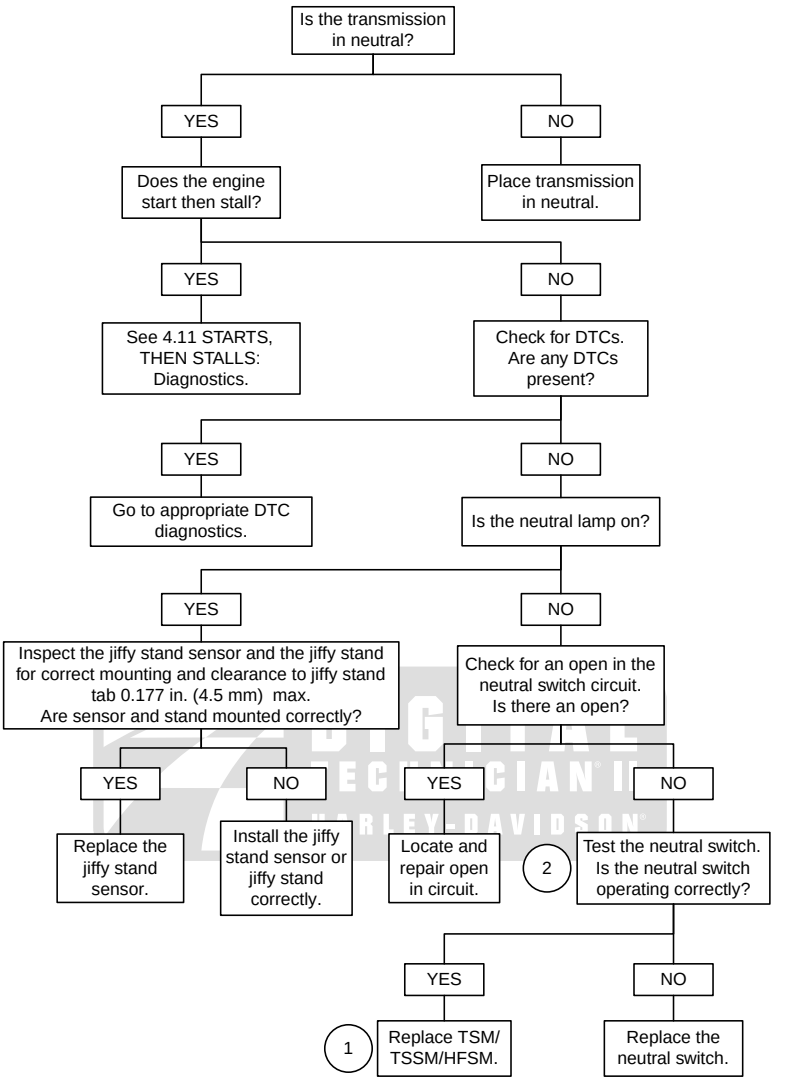


Figure 4-74. Jiffy Stand Sensor Circuit

Table 4-66. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[78]	ECM	All	73-place Delphi	Under seat
[133]	Jiffy stand sensor	HDI and FLHTP	3-place Molex	Rear of front lower frame crossmember

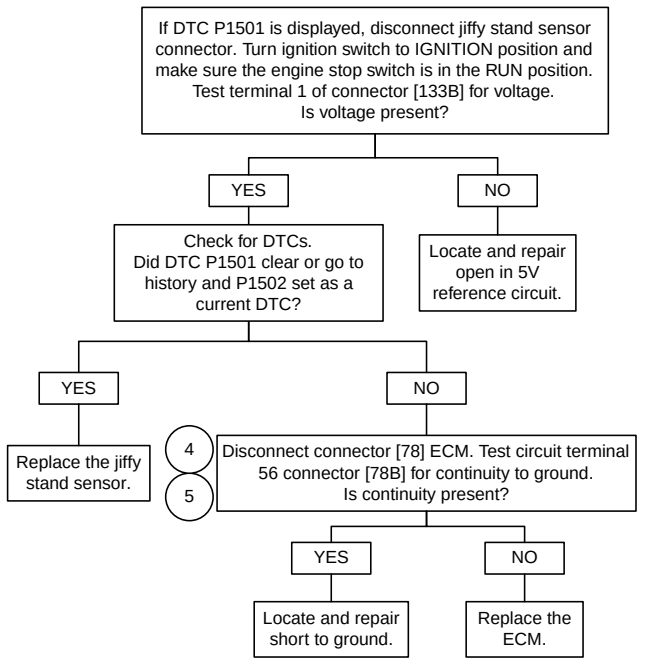
Side Stand Displayed on Odometer



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

fc02212_en

DTC P1501

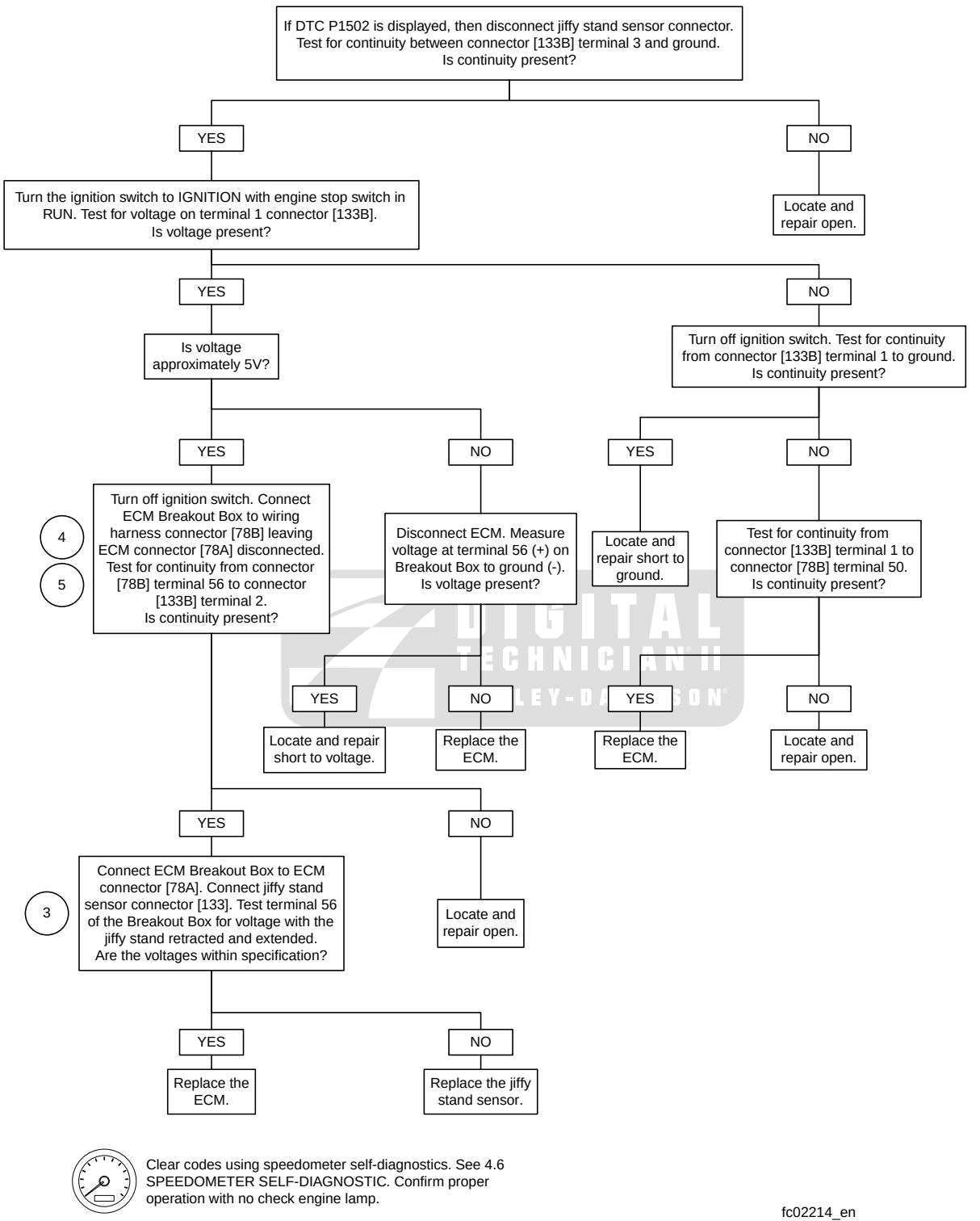


Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTC P1502


If DTC P1502 is displayed, then disconnect jiffy stand sensor connector. Test for continuity between connector [133B] terminal 3 and ground. Is continuity present?
YES
NO
Turn the ignition switch to IGNITION with engine stop switch in RUN. Test for voltage on terminal 1 connector [133B]. Is voltage present?
Locate and repair open.
YES
NO
Is voltage approximately 5V?
Turn off ignition switch. Test for continuity from connector [133B] terminal 1 to ground. Is continuity present?
YES
NO
YES
NO
4
5
Turn off ignition switch. Connect ECM Breakout Box to wiring harness connector [78B] leaving ECM connector [78A] disconnected. Test for continuity from connector [78B] terminal 56 to connector [133B] terminal 2. Is continuity present?
Disconnect ECM. Measure voltage at terminal 56 (+) on Breakout Box to ground (-). Is voltage present?
Locate and repair short to ground.
Test for continuity from connector [133B] terminal 1 to connector [78B] terminal 50. Is continuity present?
YES
NO
YES
NO
Locate and repair short to voltage.
Replace the ECM.
Replace the ECM.
Locate and repair open.
YES
NO
3
Connect ECM Breakout Box to ECM connector [78A]. Connect jiffy stand sensor connector [133]. Test terminal 56 of the Breakout Box for voltage with the jiffy stand retracted and extended. Are the voltages within specification?
Locate and repair open.
YES
NO
Replace the ECM.
Replace the jiffy stand sensor.
Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.
fc02214_en

DTC P1510, P1511, P1512 4.35

GENERAL

Throttle Actuation Control Management

The ECM constantly monitors throttle actuation and throttle component positioning. Several safety features are programmed into the ECM to limit performance (refer to Table 4-67) when an error or fault in throttle actuation is detected. These DTCs always accompany another code.

Table 4-67. Code Description

DTC	DESCRIPTION
P1510	Throttle actuator control limited performance mode
P1511	Throttle actuator control power management mode
P1512	Throttle actuator control forced idle mode

Performance limitations are identified by code, as follows:

- **P1510 Limited Performance:** Enables near normal operation of the vehicle, guarding against inadvertent wide open throttle conditions. Typically this code is the result if one of the TGS or TP sensors, or one of each, has failed.
- **P1511 Power Management:** Provides more limitation on driveability, due to failure of the TCA, without a TGS, MAP or airflow faults. The TCA is de-energized and the throttle plate returns to its idle detent position. The ECM monitors the operation of the TGS and adjusts the spark advance and cylinder shutoff/rev limiting, allowing the vehicle to reach traffic speeds (limp-home).
- **P1512 Forced Idle Mode:** Provides extreme limitation of driveability, due to a failure of both TGS, TGS validation error, or failure of one TGS and the brake switch. The TCA is de-energized and the throttle plate is forced to a fast idle position providing enough torque to operate at a high idle speed.

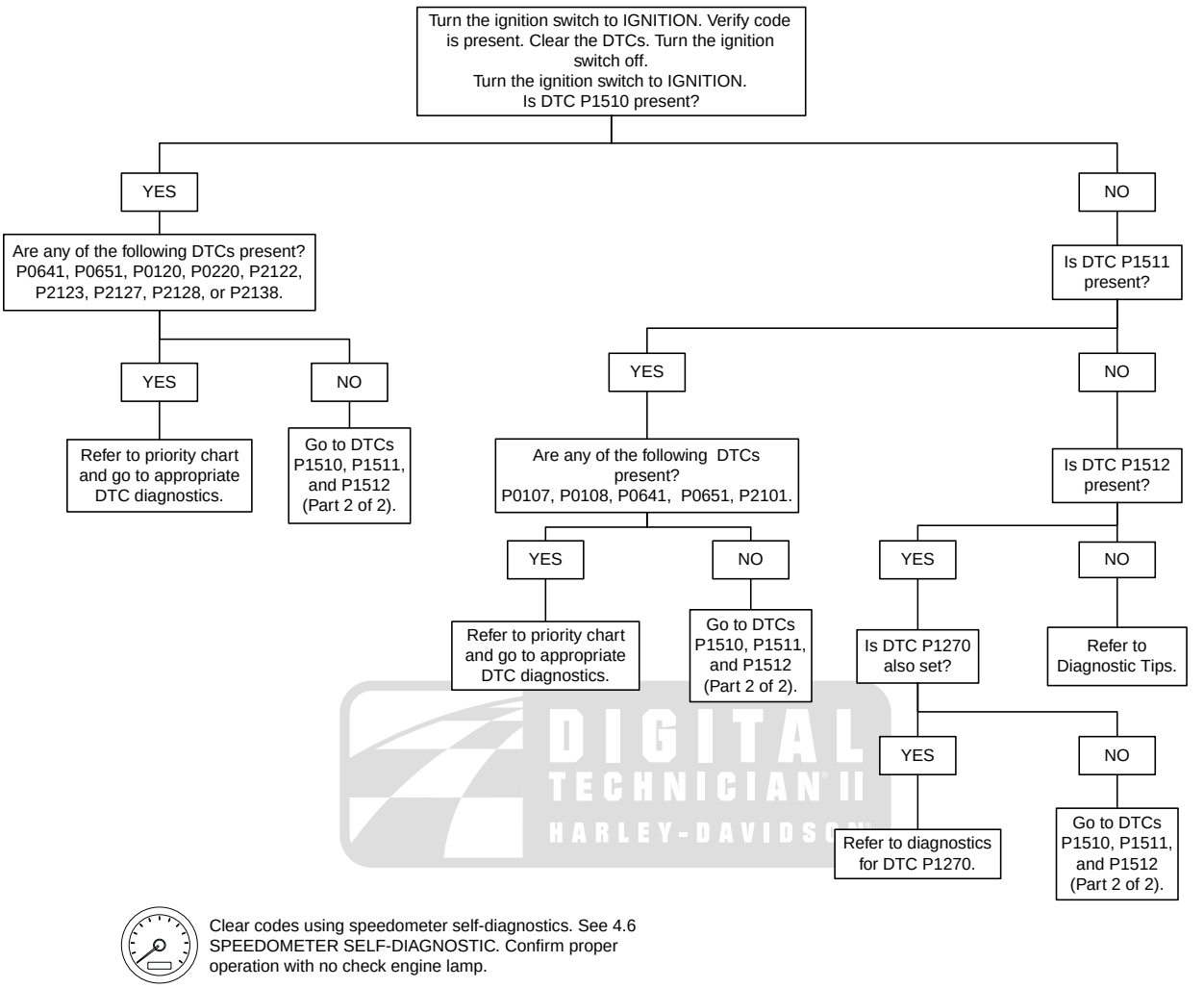
DIAGNOSTICS

Diagnostic Tips

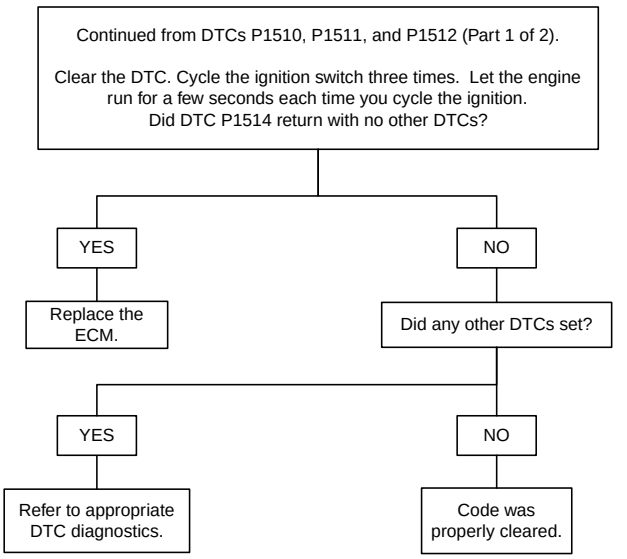
DTCs P1510, P1511 and P1512 may remain for one extra ignition cycle after other codes are cleared.

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DTCs P1510, P1511, and P1512 (Part 1 of 2)



DTCs P1510, P1511, and P1512 (Part 2 of 2)



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DTC P1514 4.36

GENERAL

Air Flow Fault

The ECM uses the TMAP sensor to monitor air flow past the throttle plate. This ensures proper throttle plate positioning, when the throttle is released and allowed to return to the unpowered position. The unpowered position is typically 7% of throttle plate range.

In order to avoid inconsistent readings at low RPM (or at idle), testing air flow is only performed at engine speeds above normal idle (10% of throttle plate range or approximately 1300 RPM).

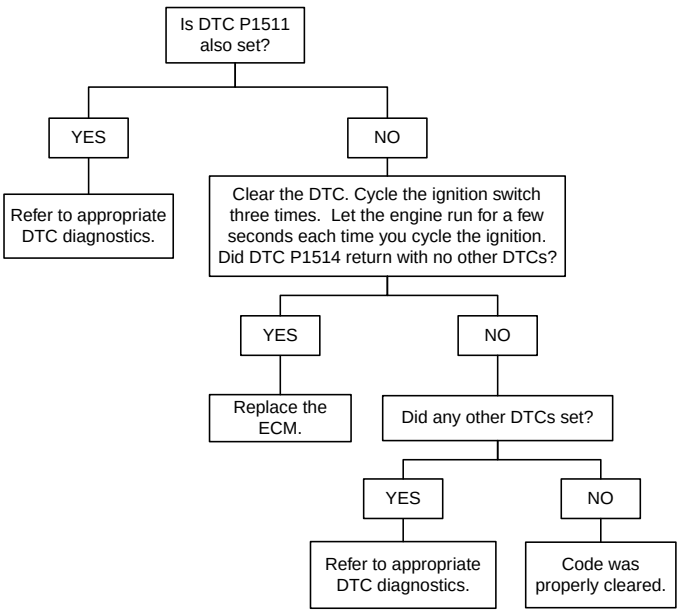
The ECM compares the intake manifold pressure value from the TMAP to the throttle plate position value from the TPS. DTC 1514 sets if the manifold pressure is higher than it should be for that given throttle plate position for three consecutive ignition cycles. If a TMAP sensor error is present, then the ECM does not check P1514 parameters and instead P2105 (forced shutdown mode) is initiated, shutting down the fuel pump and fuel injectors. See 4.39 DTC P2105. The ECM only checks for DTC P1514 if power management mode (DTC P1511) is present.

Table 4-68. Code Description

DTC	DESCRIPTION
P1514	Air flow fault

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DTC P1514



fc02216_en

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DTC P1600 4.37

GENERAL

The ECM integrates a main microprocessor and a watchdog microcontroller, used to communicate with the throttle actuation control system.

The watchdog microcontroller communicates with the main microprocessor of the ECM, and when a communication failure is identified, the watchdog shuts down the TCA and fuel injectors.

An internal ignition delay timer monitors when the ignition circuit is energized. The watchdog issues DTC P1600 if no communication is established between the main microprocessor and the watchdog microcontroller or if a watchdog failure occurs within three consecutive ignition cycles.

Table 4-69. Code Description

DTC	DESCRIPTION
P1600	TCA module processor - internal fault

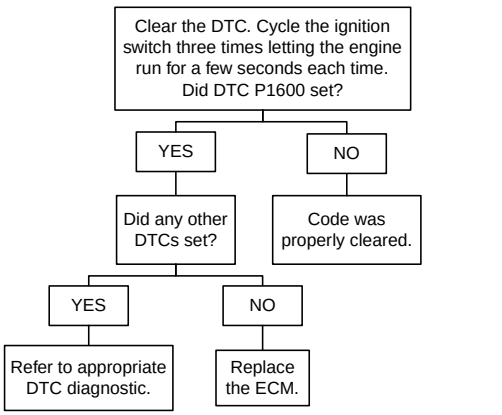
DIAGNOSTICS

Diagnostic Tips

- An intermittent may be caused by poor connection, rubbed through wire insulation or an inoperative wire inside the insulation.
- **Poor connection**: Inspect component and harness connectors for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harnesses.

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DTC P1600



fc02217_en

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DTC P2100, P2101, P2102, P2103 4.38

GENERAL

The ECM incorporates an H-Bridge driver chip which provides diagnostics for the TAC system.

The TCA contains two potentiometers (designated as TPS1 and TPS2) and an electric DC motor for controlling the actuation of the throttle. TPS1 and TPS2 are mounted in the TCA. They are connected to the keyed shaft for the throttle plate and used to communicate the position of the throttle plate.

Each TPS supplies input to the ECM in response to the positioning of the throttle plate. The ECM activates the motor in the TCA to move the throttle plate, based on signals from the TGS.

The TCA motor receives input (position data) from the ECM connector [78] terminal 29 for electronic throttle control - HI and terminal 30 for electronic throttle control - LOW. The TCA motor drives a series of gears to rotate the position of the throttle plate. Refer to Table 4-70 for defect codes associated with TCA drive motor and see Figure 4-75 for TCA circuitry diagram.

Table 4-70. Code Description

DTC	DESCRIPTION
P2100	TAC motor open
P2101	TAC motor circuit range/performance (actuation error)
P2102	TAC motor control circuit shorted low
P2103	TAC motor control circuit shorted high

- **P2100 TAC Motor Circuit Open:** Indicates the ECM identified an open load fault for the TCA motor driver.
- **P2101 TAC Motor Circuit Range/Performance:** Indicates the actual position of the throttle plate is out of range from the commanded throttle plate position.
- **P2102 TAC Motor Control Circuit Shorted Low:** Indicates the ECM identified that the drive motor is shorted to ground within the TAC drive motor circuit.
- **P2103 TAC Motor Control Circuit Shorted High:** Indicates the drive motor is shorted high within the TAC drive motor circuit.

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Tips

- An intermittent may be caused by poor connection, rubbed through wire insulation or an inoperative wire inside the insulation.
- **Poor connection**: Inspect component and harness connectors for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harnesses.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) to the ECM and ECM harness. See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes, socket probes and patch cords.

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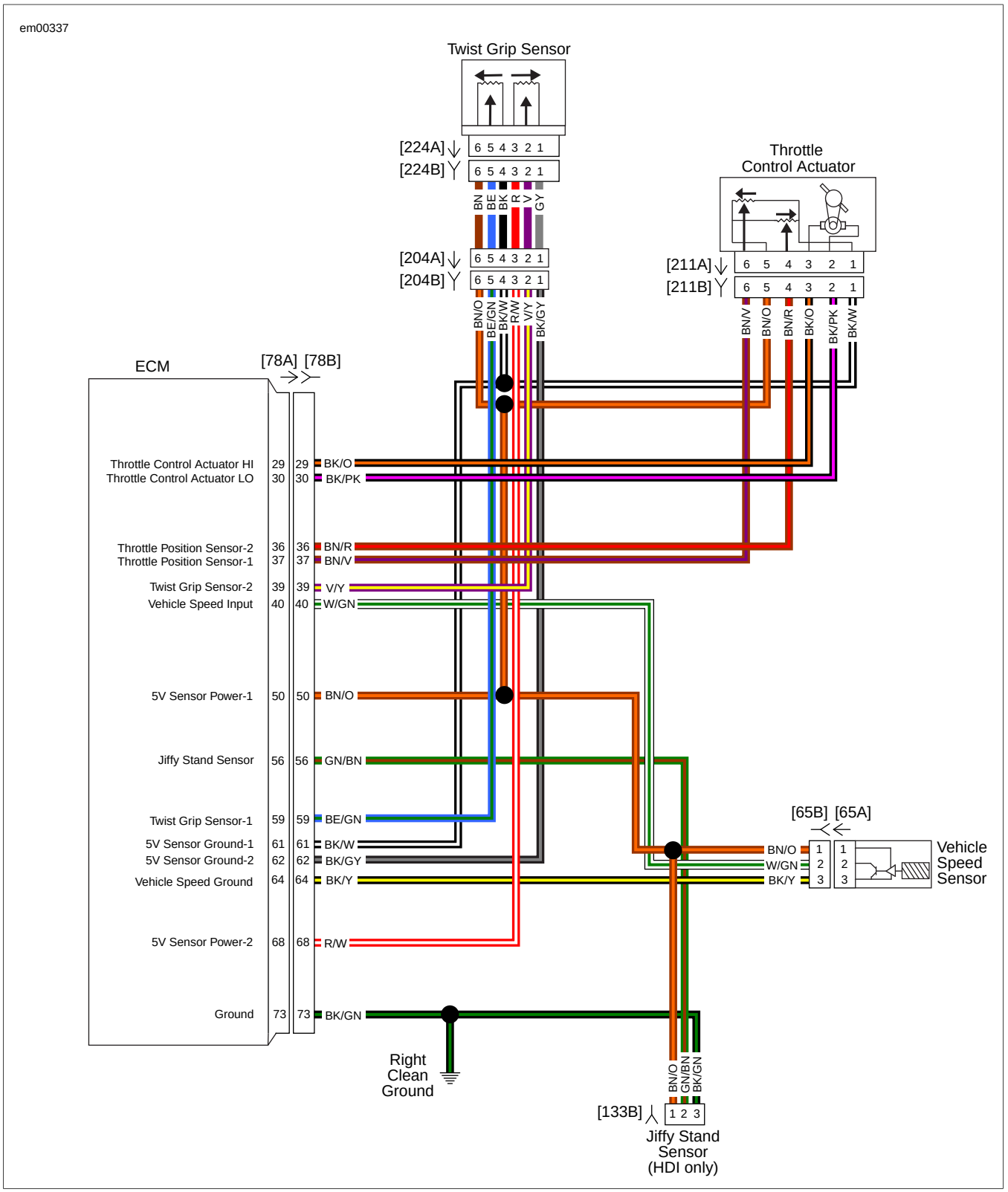


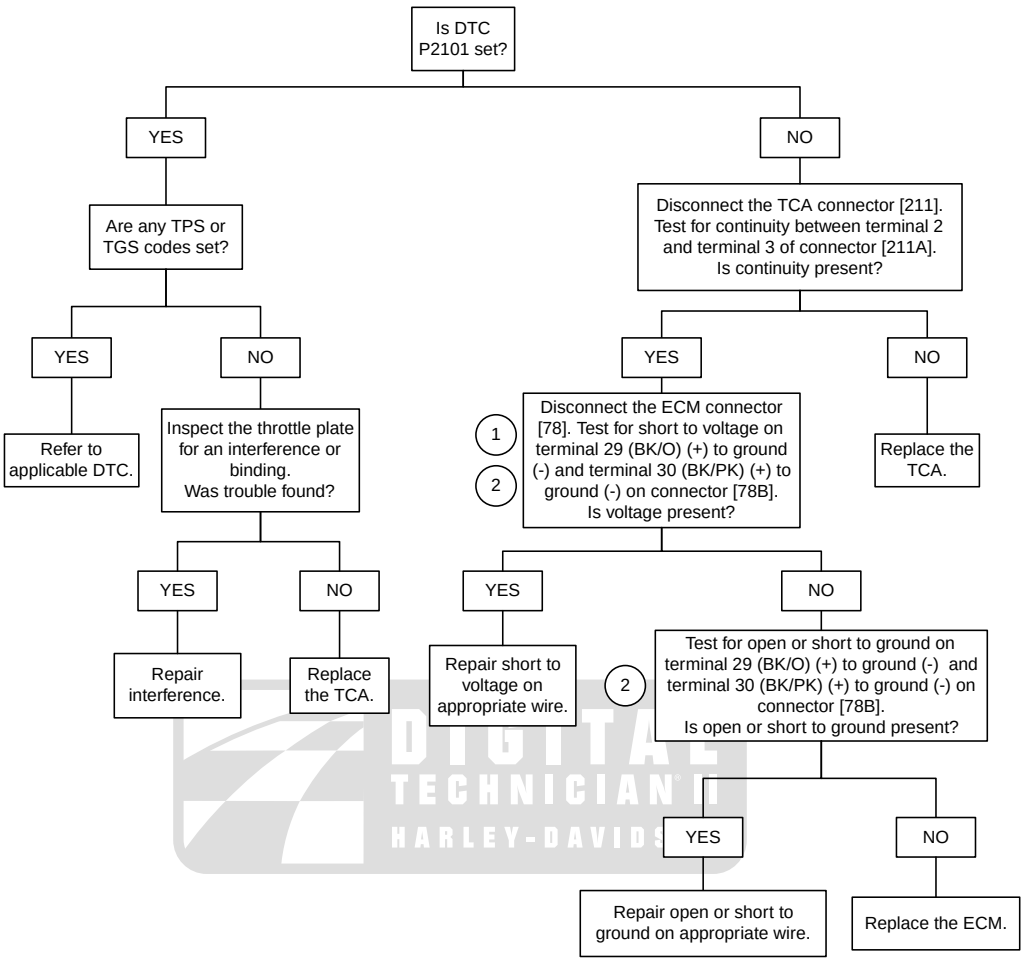
Figure 4-75. TCA Circuit

Table 4-71. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[65]	VSS	All	3-place Delphi	Top of transmission case (under starter)
[78]	ECM	All	73-place Delphi	Under seat
[133]	Jiffy stand sensor	All	3-place Molex (black)	Domestic (not used) HDI: Rear of lower front frame cross-member
[204]	TGS harness	FLHT/C/U/X	6-place Molex (black)	Inner fairing - right radio support bracket
		FLTR	6-place Molex (black)	Inner fairing - right side below radio
		FLHR	6-place Molex (black)	Inside headlamp nacelle, fork stem nut lock plate
[211]	TCA	All	6-place Molex	Right side of engine (induction module)
[224]	TGS	All	7-place Amp (Tyco)	Handlebar throttle (inside right side of handlebar)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTCs P2100, P2101, P2102, and P2103



fc02218_en

DTC P2105 4.39

GENERAL

The TAC system uses DTC P2105 as a vehicle safety device. It provides a forced shut down of the engine when the performance of the TCA cannot be verified. Refer to Table 4-72.

Initially, the ECM commands the fuel pump and fuel injectors to be disabled until the actual fault is cleared.

Table 4-72. Code Description

DTC	DESCRIPTION
P2105	TAC system forced engine shutdown

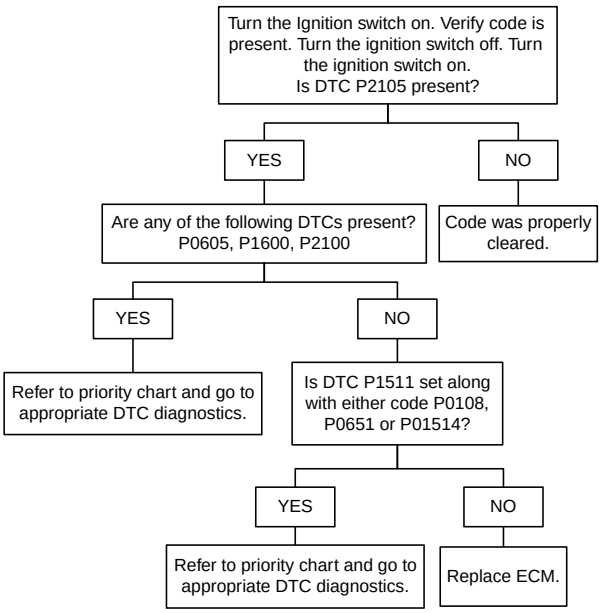
DIAGNOSTICS

Diagnostic Notes

Refer to and conduct diagnostics as identified on the flowchart.

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DTC P2105



Clear codes using speedometer self-diagnostics.
See 4.6 SPEEDOMETER SELF-DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

fc02233_en

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC P2107 4.40

GENERAL

The TAC system sets DTC P2107 to identify faults with the ECM due to an internal over-temperature shutdown or a power supply failure. Refer to Table 4-73.

Table 4-73. Code Description

DTC	DESCRIPTION
P2107	TAC system module processor - internal fault

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-48637	BREAKOUT BOX

Diagnostic Tips

This code usually sets due to an internal problem with the ECM. However, poor connections and high resistance on (Y/GN) 12V power wire can also cause this code to set. If the code does not reset after it is cleared, check for an intermittent poor connection on this wire.

Diagnostic Notes

Connect BREAKOUT BOX (Part No. HD-48637) to the ECM and ECM harness. See 4.7 BREAKOUT BOX: EFI.

Refer to and conduct diagnostics as identified on the flowchart.

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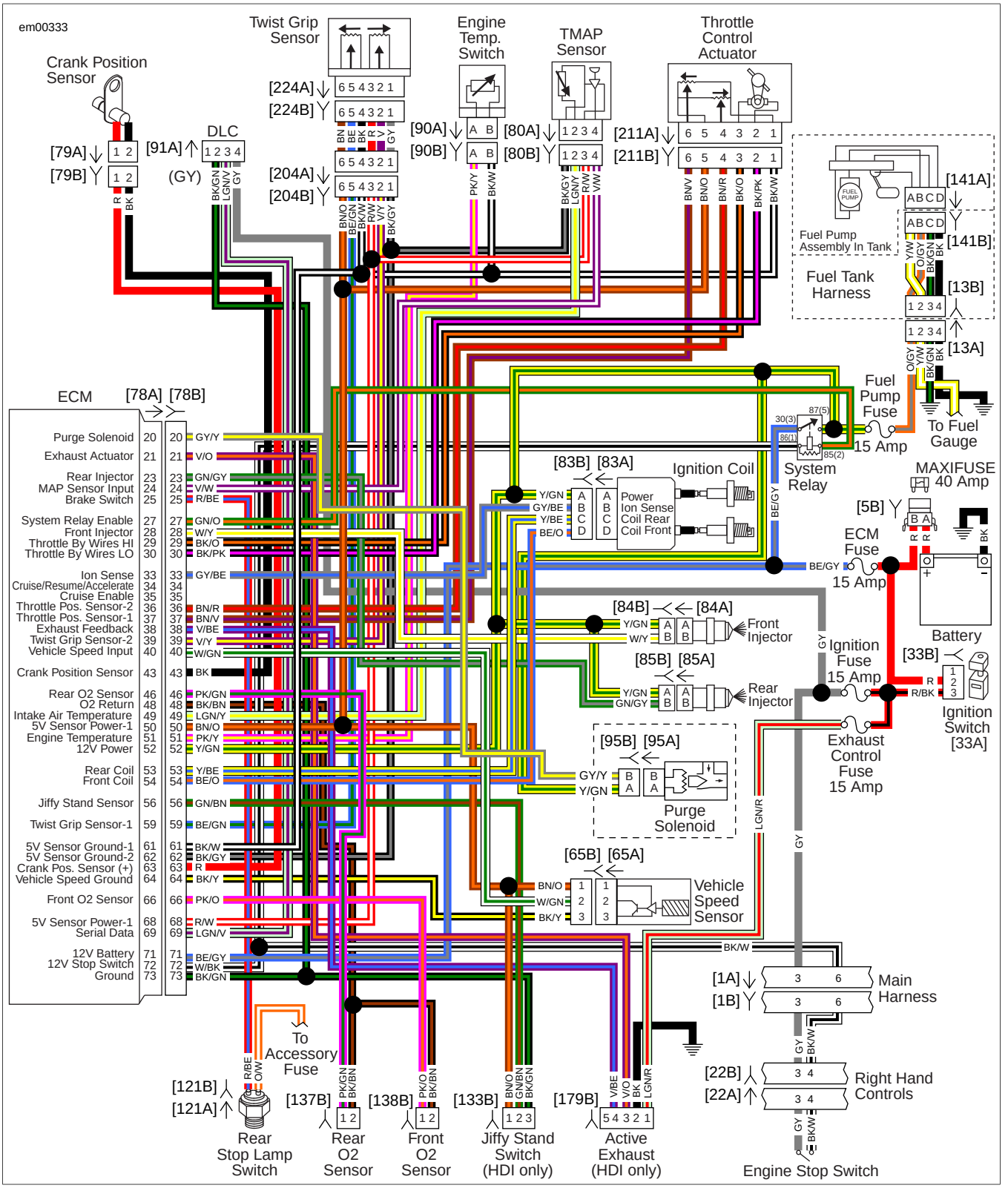


Figure 4-76. System Relay Circuit (FLHX, FLHT/C/U, FLTR)

Table 4-74. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	All	16-place Molex (black)	Inner fairing (right radio support bracket)
[5]	MAXIFUSE	All	2-place Packard	Under left side cover
[13]	Fuel tank harness	All	4-place Multilock	Behind fuel tank (under seat)
[22]	Right handlebar switches	FLHX, FLHT/C/U	12-place Molex (black)	Right fairing support bracket
		FLTR	12-place Molex (black)	Inner fairing (on left fairing support bracket)
[33]	Ignition switch	All	3-place Packard	Bottom of ignition switch housing
[65]	VSS	All	3-place Delphi	Top of transmission case (under starter)
[78]	ECM	All	73-place Delphi	Under seat
[79]	CKP sensor	All	2-place Mini-Deutsch	Rear of lower front frame crossmember
[80]	TMAP sensor	All	4-place Bosch	Top of induction module
[83]	Ignition coil	All	4-place Delphi	Bottom front of battery tray
[84]	Front injector	All	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	All	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	All	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	All	4-place Deutsch	Under left side cover
[95]	Purge solenoid	All	2-place Delphi	Under seat
[121]	Rear stop lamp switch	All	Spade terminal	Bottom of rear frame downtube (right side)
[133]	Jiffy stand sensor	All	3-place Molex (black)	Domestic (not used) HDI: Rear of front lower frame crossmember
[137]	O2 sensor rear exhaust header	All	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	All	2-place Amp (Tyco)	Back of cross brace front frame downtubes
[141]	Fuel pump and fuel level sender	All	4-place Packard	Under console (on top of fuel tank canopy)
[179]	Active exhaust actuator	All	5-place Amp (Tyco)	Domestic (not used): Under right side cover HDI: Under right side cover (behind electrical bracket)
[204]	TGS harness	All	6-place Molex	Inner fairing (right fairing support bracket)
[211]	TCA	All	6-place Molex	Right side of engine (induction module)
[224]	TGS	All	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)

DIGITAL TECHNICIAN HARLEY-DAVIDSON

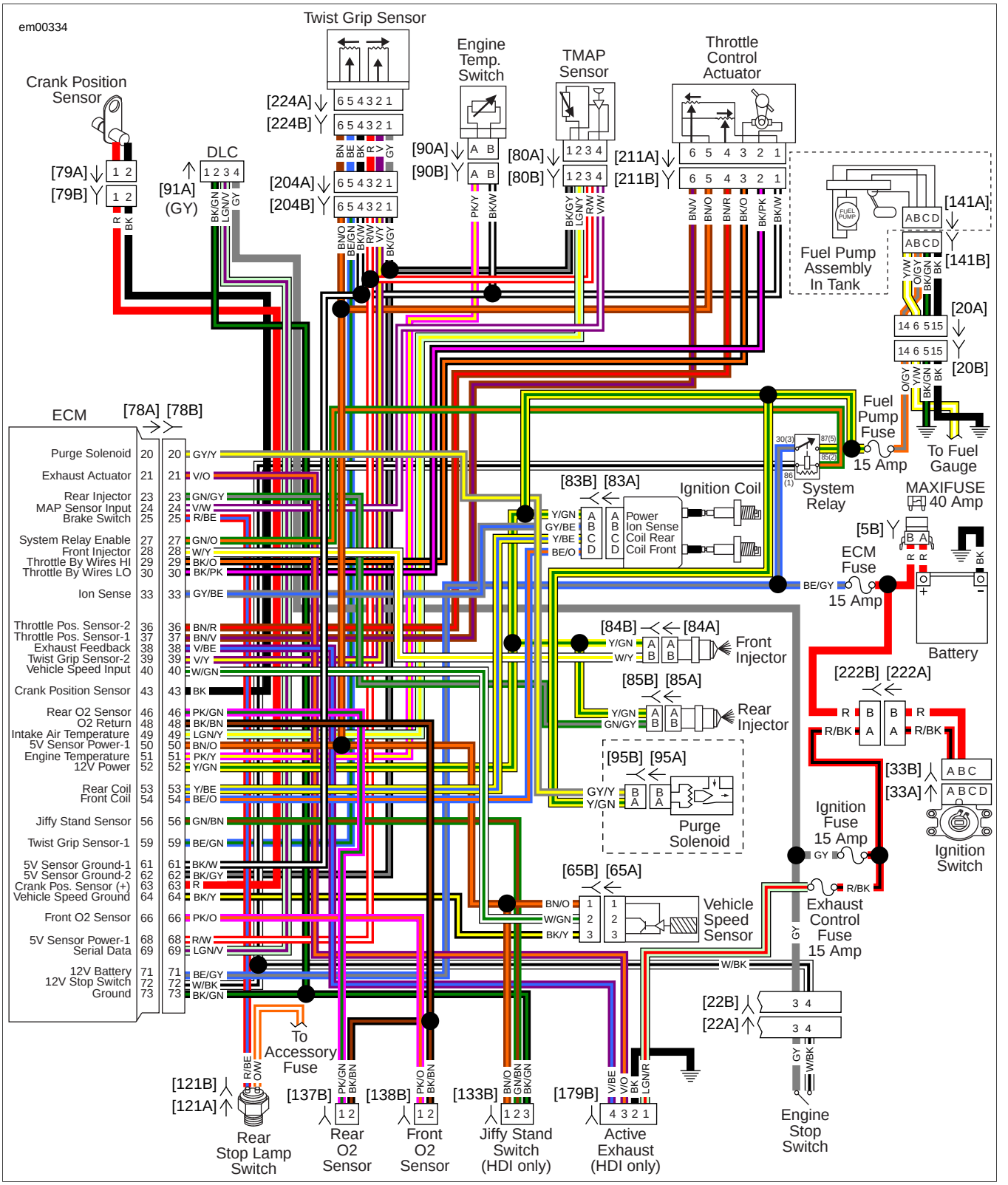


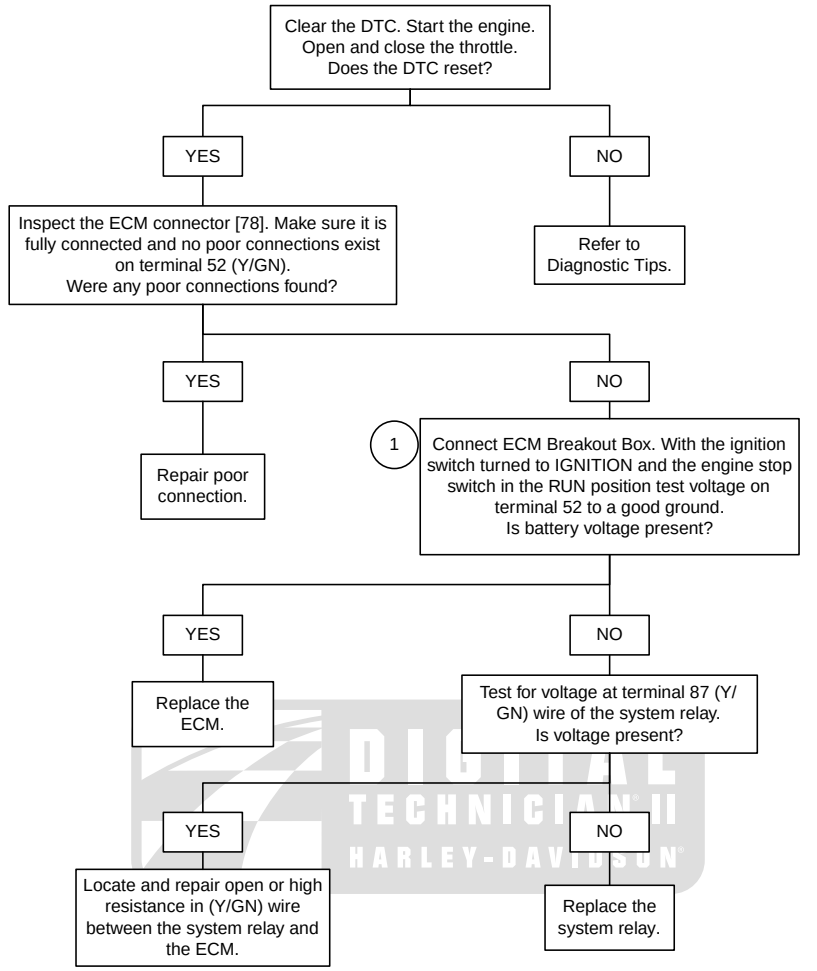
Figure 4-77. System Relay Circuit (FLHR/C)

Table 4-75. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[5]	MAXIFUSE	2-place Packard	Under left side cover
[13]	Fuel tank harness	4-place Multilock	Behind fuel tank (under seat)
[20]	Console harness	16-place Molex	Under seat
[22]	Right handlebar switches	6-place Molex (black)	Inside headlamp nacelle (fork stern nut lock plate right side)
[33]	Ignition switch	3-place Packard	Under console
[65]	VSS	3-place Delphi	Top of transmission case (under starter)
[78]	ECM	73-place Delphi	Under seat
[79]	CKP sensor	2-place Mini-Deutsch	Rear of front lower frame crossmember
[80]	TMAP sensor	4-place Bosch	Top of induction module
[83]	Ignition coil	4-place Delphi	Bottom front of battery tray
[84]	Front injector	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	4-place Deutsch	Under left side cover
[95]	Purge solenoid	2-place Delphi	Under seat
[121]	Rear stop lamp switch	Spade terminal	Bottom of rear frame downtube (right side)
[133]	Jiffy stand sensor	3-place Molex (black)	Domestic (not used) HDI: Rear of lower front frame cross-member
[137]	O2 sensor rear exhaust header	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	2-place Amp (Tyco)	Back of cross brace front frame down-tubes
[141]	Fuel pump and fuel level sender	4-place Packard	Top of fuel tank canopy (under con-sole)
[179]	Active exhaust actuator	5-place Amp (Tyco)	Domestic (not used) HDI: Under right side cover (behind electrical bracket)
[204]	TGS harness	6-place Molex	Inner fairing (right side below radio)
[211]	TCA	6-place Molex	Right side of engine (induction module)
[222]	Console ignition switch interconnect	4-place Packard	Under seat
[224]	TGS	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC P2107



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

fc02232_en

DTC P2119 4.41

GENERAL

The TAC system sets DTC P2119 when the ECM determines the throttle plate does not return to the correct de-energized position. This error primarily indicates there may be non-electrical conditions which affect the throttle body range/performance. Refer to Table 4-76.

Table 4-76. Code Description

DTC	DESCRIPTION
P2119	TAC system throttle body range/performance

This DTC, if initiated, may have the following probable conditions:

- Something may be physically interfering with the throttle plate operation (such as foreign material, debris, physical obstruction, or loosely/improperly mounted throttle plate).
- Damaged or inoperative throttle plate return spring.
- Defective mechanical component(s) internal to the TCA.

DIAGNOSTICS

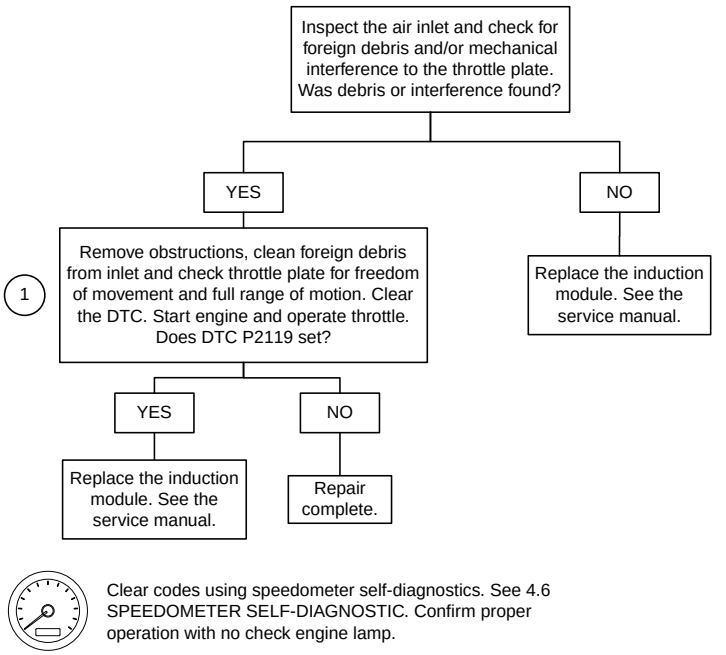
Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. The ECM must see this fault during four consecutive ignition cycles in order to set DTC P2119. When testing to see if code resets, be sure to operate vehicle through four complete, consecutive ignition cycles.

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DTC P2119



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DTC P2122, P2123, P2127, P2128 4.42

GENERAL

The TGS is an electronic assembly that replaces the conventional throttle cable. Two opposing Hall-effect sensors transmit signals to the ECM. The ECM uses these signals to determine the desired throttle plate position. The ECM controls the motor in the TCA to move the throttle plate to the desired position.

The TGS receives a 5V reference signal from the ECM. As the throttle plate is opened the TGS1 signal voltage increases and TGS2 signal voltage decreases. By design, the sum of the voltages when measured for both TGS1 and TGS2 should equal approximately 5.0 volts. If the sum of these voltages is not 5.0 Volts, then DTCs are initiated for TGS1 and/or TGS2.

The ECM monitors and controls the TAC system and generates DTCs when errors are reported by the ECM. Refer to Table 4-77.

Table 4-77. Code Description

DTC	DESCRIPTION
P2122	TGS1 low/open
P2123	TGS1 high
P2127	TGS2 low/open
P2128	TGS2 high

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Tips

- An intermittent may be caused by poor connection, rubbed through wire insulation or an inoperative wire inside the insulation.
- **Poor connection**: Inspect component and harness connectors for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harnesses.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) to the ECM and ECM harness. See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes, socket probes and patch cords.

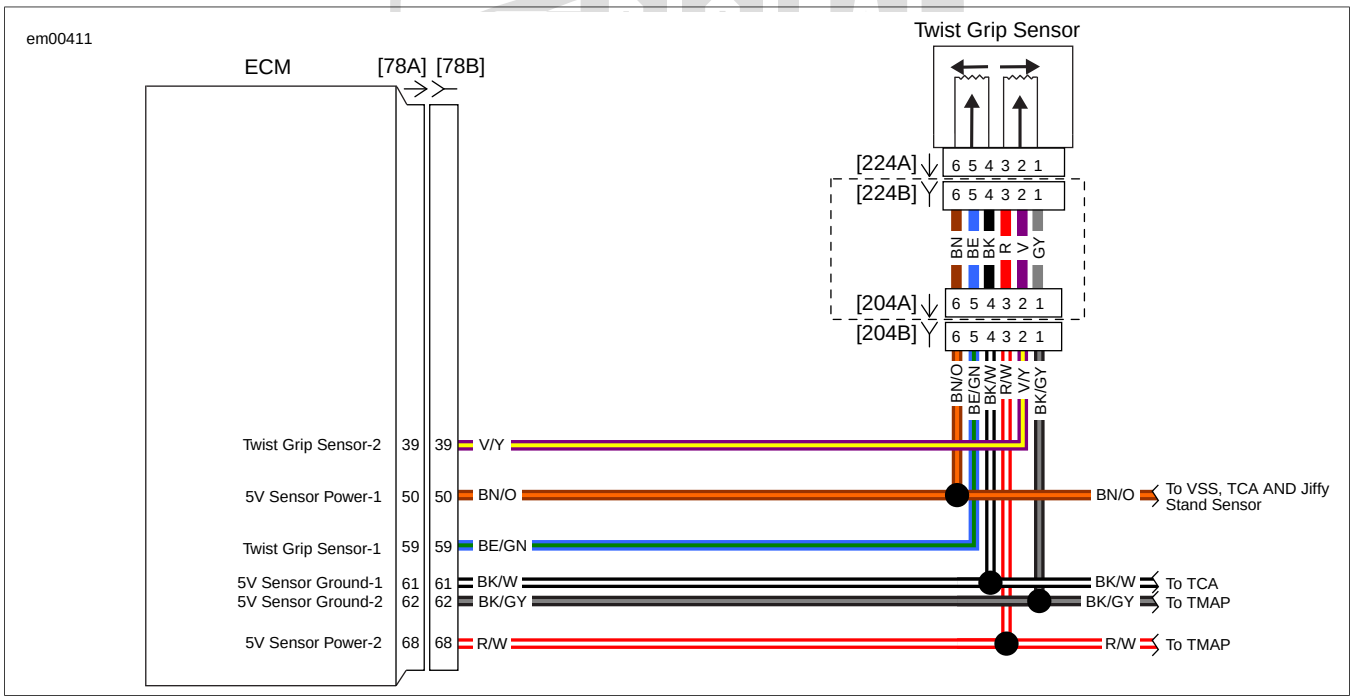


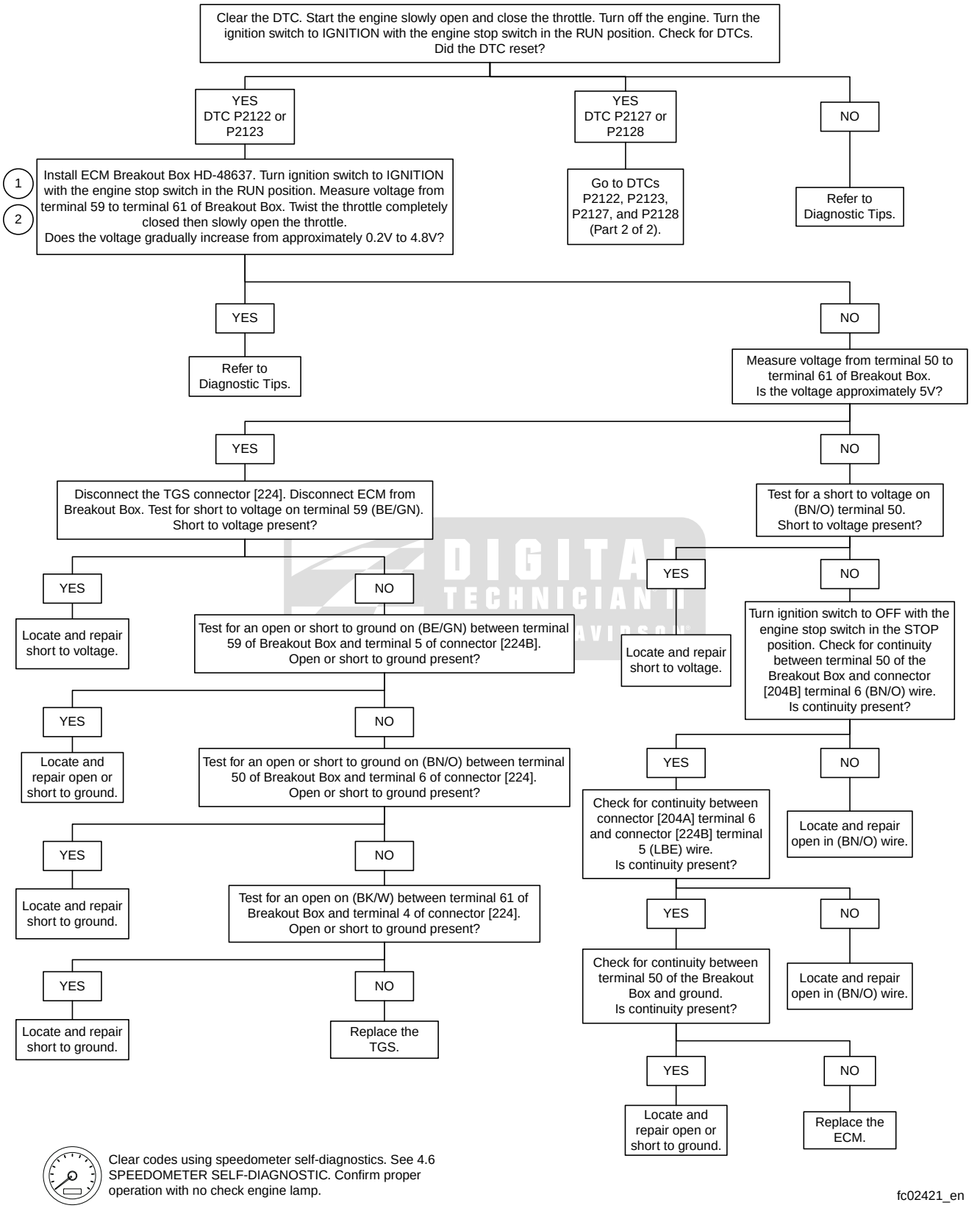
Figure 4-78. Twist Grip Sensor (TGS) Circuit

Table 4-78. Wire Harness Connectors

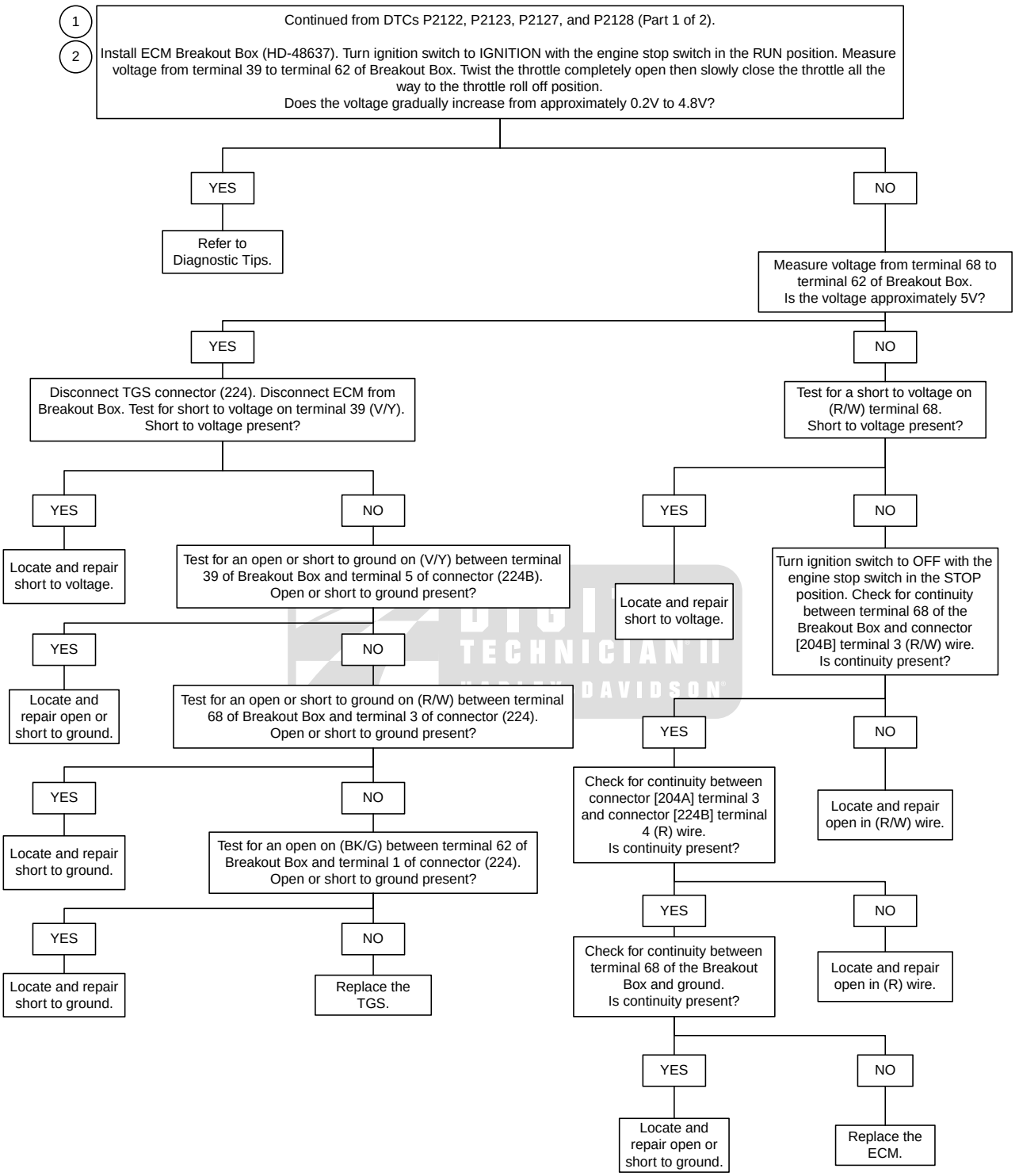
NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[78]	ECM	All	73-place Delphi	Under seat
[204]	TGS harness	FLHT/C/U/X	6-place Molex	Inner fairing - right fairing support bracket
		FLTR	6-place Molex	Inner fairing right side below radio
		FLHR	6-place Molex	Inside headlamp nacelle, fork stem nut lock plate
[224]	TGS	All	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)

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DTCs P2122, P2123, P2127, and P2128 (Part 1 of 2)



DTCs P2122, P2123, P2127, and P2128 (Part 2 of 2)



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DTC P2135, P2138 4.43

GENERAL

The TAC system uses DTCs when the ECM determines that a correlation error exists for either the TP sensor or the TGS.

The two TP sensors work opposite of each other. As the throttle plate opens, TPS1 voltage ranges from 0.0-5.0V, while TPS2 voltage ranges from 5.0-0.0V. The sum of the two TPS voltages should always measure approximately 5.0V.

The two TGSs work the same way. As the throttle plate is opened, TGS1 voltage increases and TGS2 voltage decreases. The sum of these two voltages should always measure approximately 5.0V. If either of these components fail to correlate the proper voltage, or has out-of-range voltage conditions, then the ECM will initiate a DTC. Refer to Table 4-79.

Table 4-79. Code Description

DTC	DESCRIPTION
P2135	TPS correlation error
P2138	TGS correlation error

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48637	BREAKOUT BOX

Diagnostic Tips

- An intermittent may be caused by poor connection, rubbed through wire insulation or an inoperative wire inside the insulation.
- **Poor connection**: Inspect component and harness connectors for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harnesses.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48637) to the ECM and ECM harness. See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes, socket probes and patch cords.

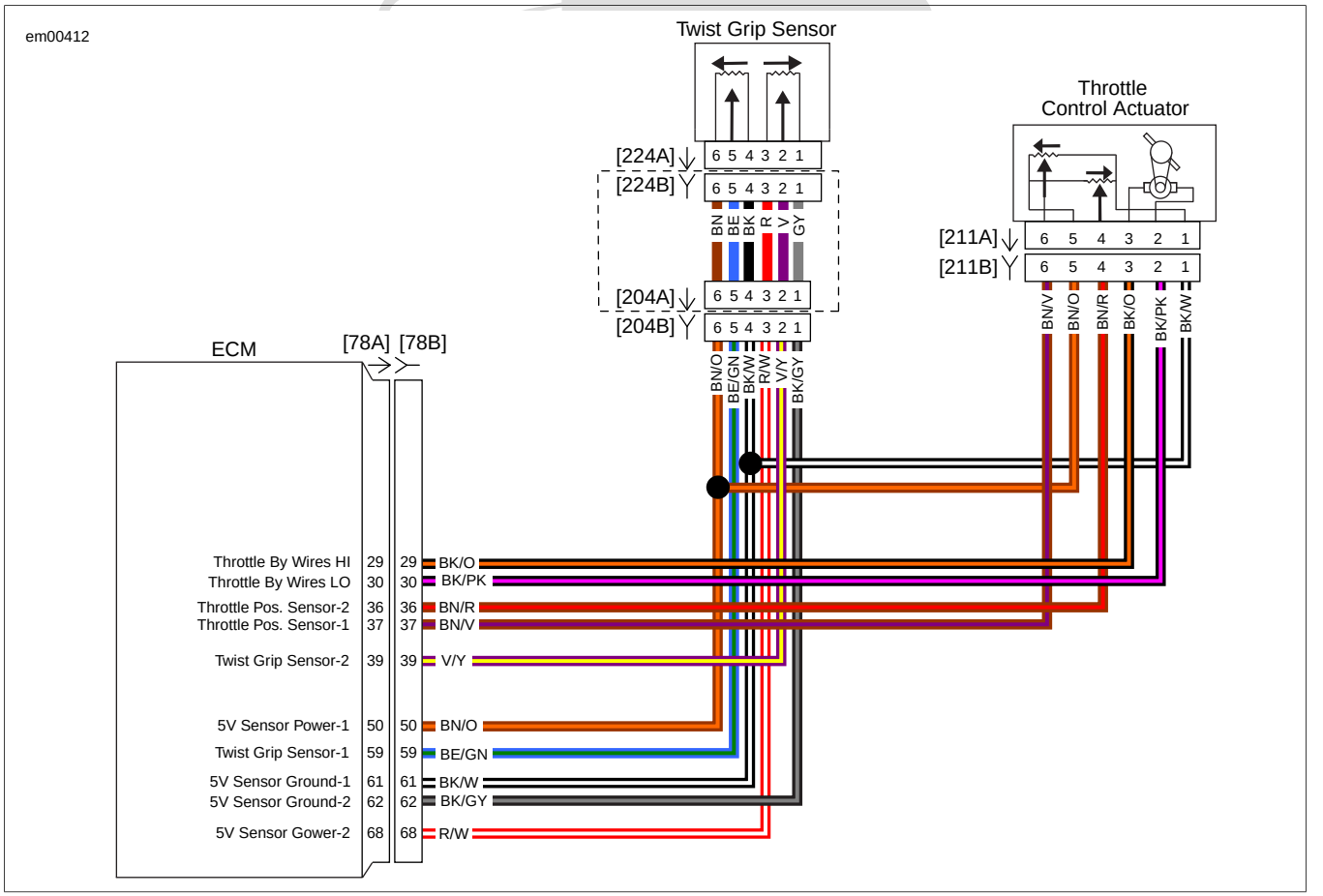


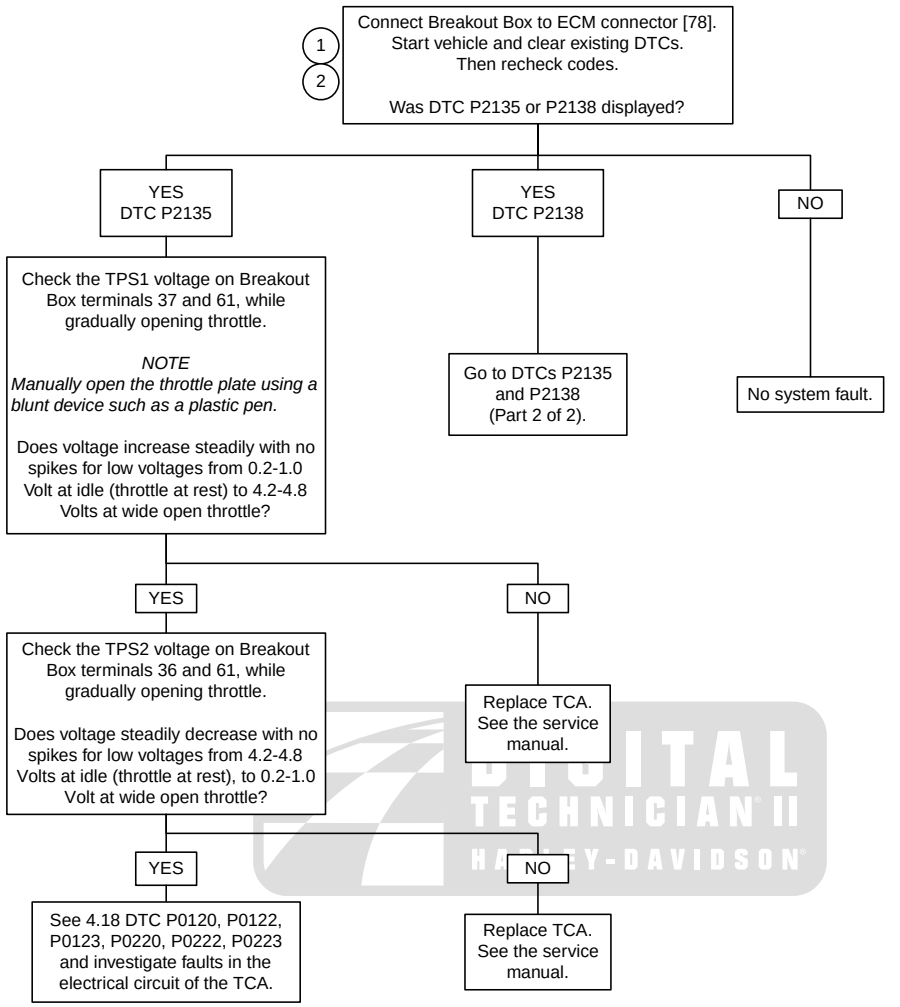
Figure 4-79. TGS/TPS Control Circuit

Table 4-80. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[78]	ECM	All	73-place Delphi	Under seat
[204]	TGS harness	FLHT/C/U	6-place Molex	Inner fairing - right radio support bracket
		FLHR	6-place Molex	Inner fairing - right side below radio
		FLTR	6-place Molex	Inside headlamp nacelle - fork stem nut lock plate
[211]	TCA	All	6-place Molex	Right side of engine (induction module)

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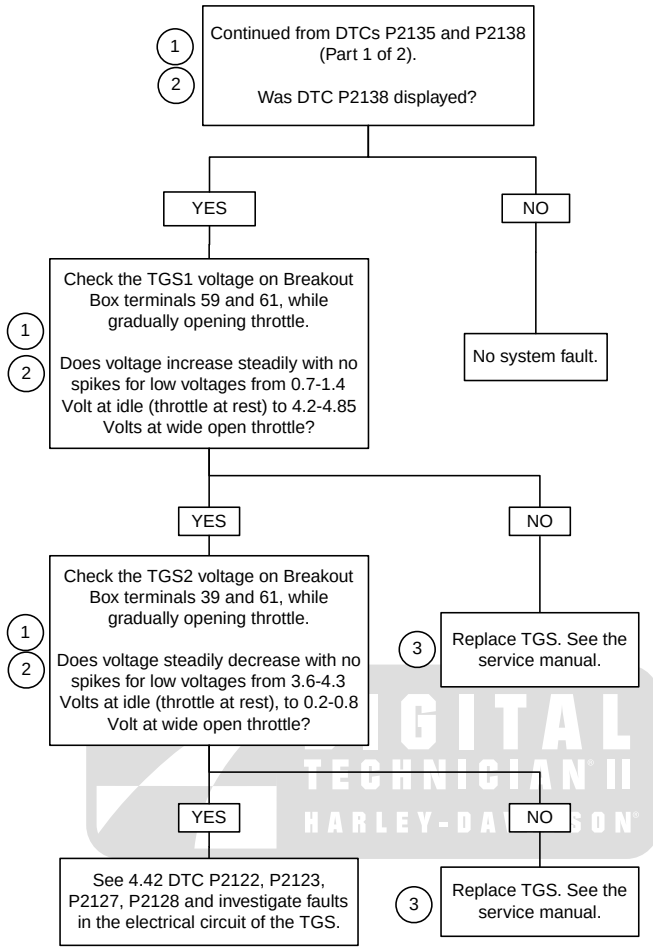
DTCs P2135 and P2138 (Part 1 of 2)



Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTCs P2135 and P2138 (Part 2 of 2)



fc02239_en

DTC P2176 4.44

GENERAL

The TAC system sets DTC P2176 when the ECM determines the zero position of the throttle plate has not been successfully learned.

At power up, the ECM adjusts the throttle plate to the limp-home position, then begins to move the throttle plate closed. The ECM monitors and verifies the amount of movement that occurred. The throttle plate minimum position is held briefly then verified against the expected minimum and maximum range of throttle. If the zero position is found within range, then the position is stored.

If the ECM is not able to learn the minimum position, or if the learning fails four consecutive ignition cycles, the ECM initiates DTC P2176. Refer to Table 4-81.

Table 4-81. Code Description

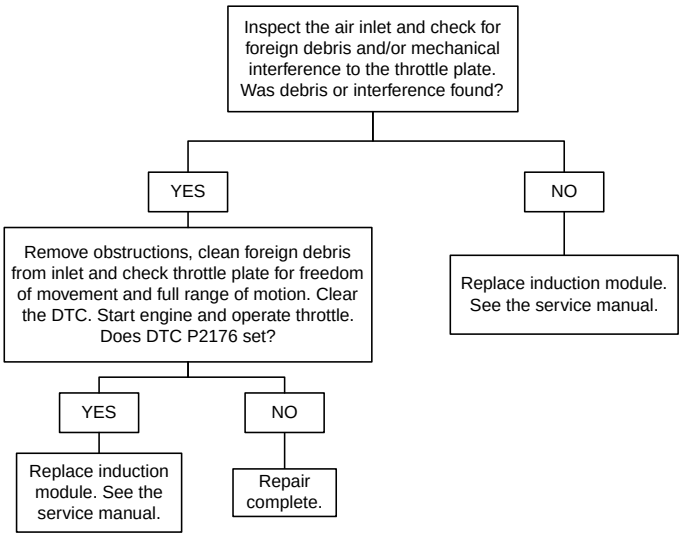
DTC	DESCRIPTION
P2176	TAC close position not learned

DIAGNOSTICS

Refer to and conduct diagnostics as identified on the flowchart.

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DTC P2176





Clear codes using speedometer self-diagnostics. See 4.6 SPEEDOMETER SELF-DIAGNOSTIC. Confirm proper operation with no check engine lamp.

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DTC U1064 4.45

GENERAL

Loss of TSM/TSSM/HFSM Serial Data

The serial data connector provides a means for the ECM, TSM/TSSM/HFSM and speedometer to communicate their current status. When all operating parameters on the serial data link are within specifications, a state of health message is sent between the components. DTC U1064 indicates the TSM/TSSM/HFSM is not receiving this state of health message. A DTC U1064 also indicates that there was communication on the data bus since power up, but communication was lost or interrupted during that key cycle.

Table 4-82. Code Description

DTC	DESCRIPTION
U1064	Loss of TSM/TSSM/HFSM serial data
U1255	Serial data error/missing message

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-48637	BREAKOUT BOX

Diagnostic Notes

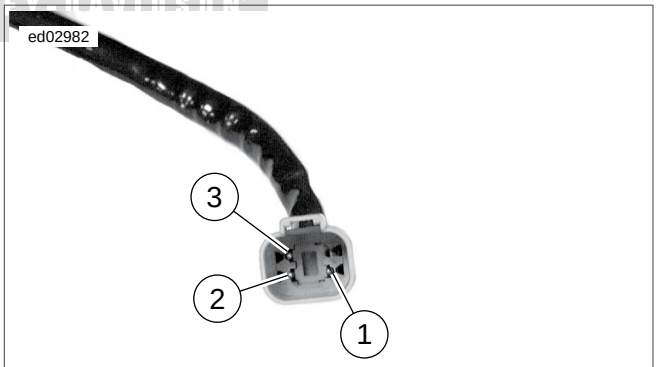
Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) as follows:
 a. Mate gray socket housing on BREAKOUT BOX (Part No. HD-42682) with TSM/TSSM/HFSM connector [30A].
 b. Mate gray pin housing on BREAKOUT BOX (Part No. HD-42682) with harness connector [30B].
2. Connect BREAKOUT BOX (Part No. HD-48637).



1. **[30] TSM/TSSM/HFSM**
2. **[208] HFSM antenna jumper harness**
3. **[209] HFSM antenna**

Figure 4-80. TSM/TSSM/HFSM Location



1. **Terminal 2: ground (BK/GN)**
2. **Terminal 3: serial data (LGN/V)**
3. **Terminal 4: power (GY)**

Figure 4-81. Data Link Connector

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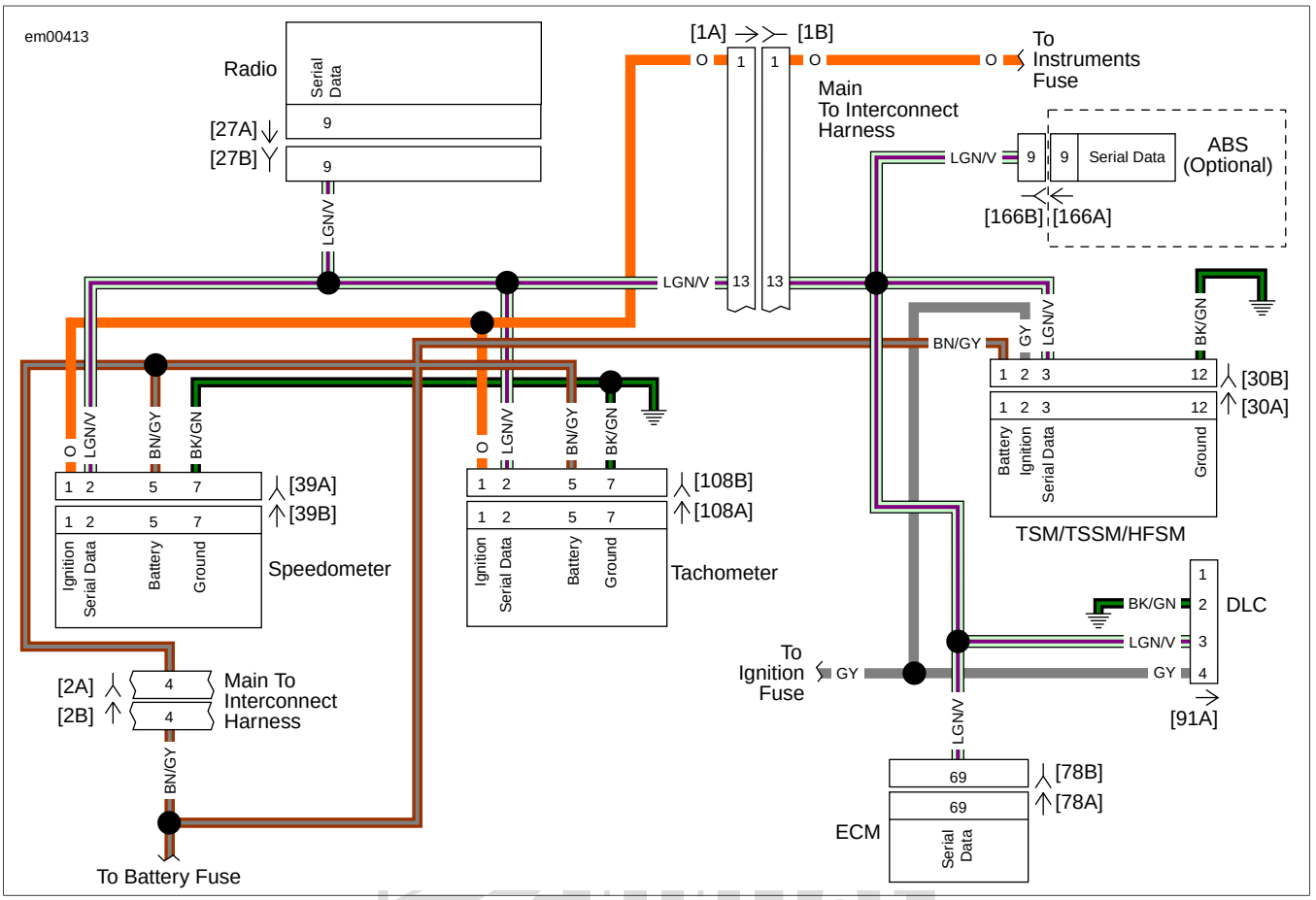


Figure 4-82. ECM and TSSM/HFSM Circuit (FLHX, FLHT/C/U, FLTR)

Table 4-83. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (black)	Inner fairing - right side below radio
[2]	Main to interconnect harness	All	12-place Molex (gray)	Inner fairing - left radio support bracket
[27]	Radio	All	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[30]	TSM/TSSM/HFSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHT/C	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
[78]	ECM	All	73-place Delphi	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover
[108]	Tachometer	FLHT/C	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)
[166]	ABS module	All	20-place Molex	Under right side cover

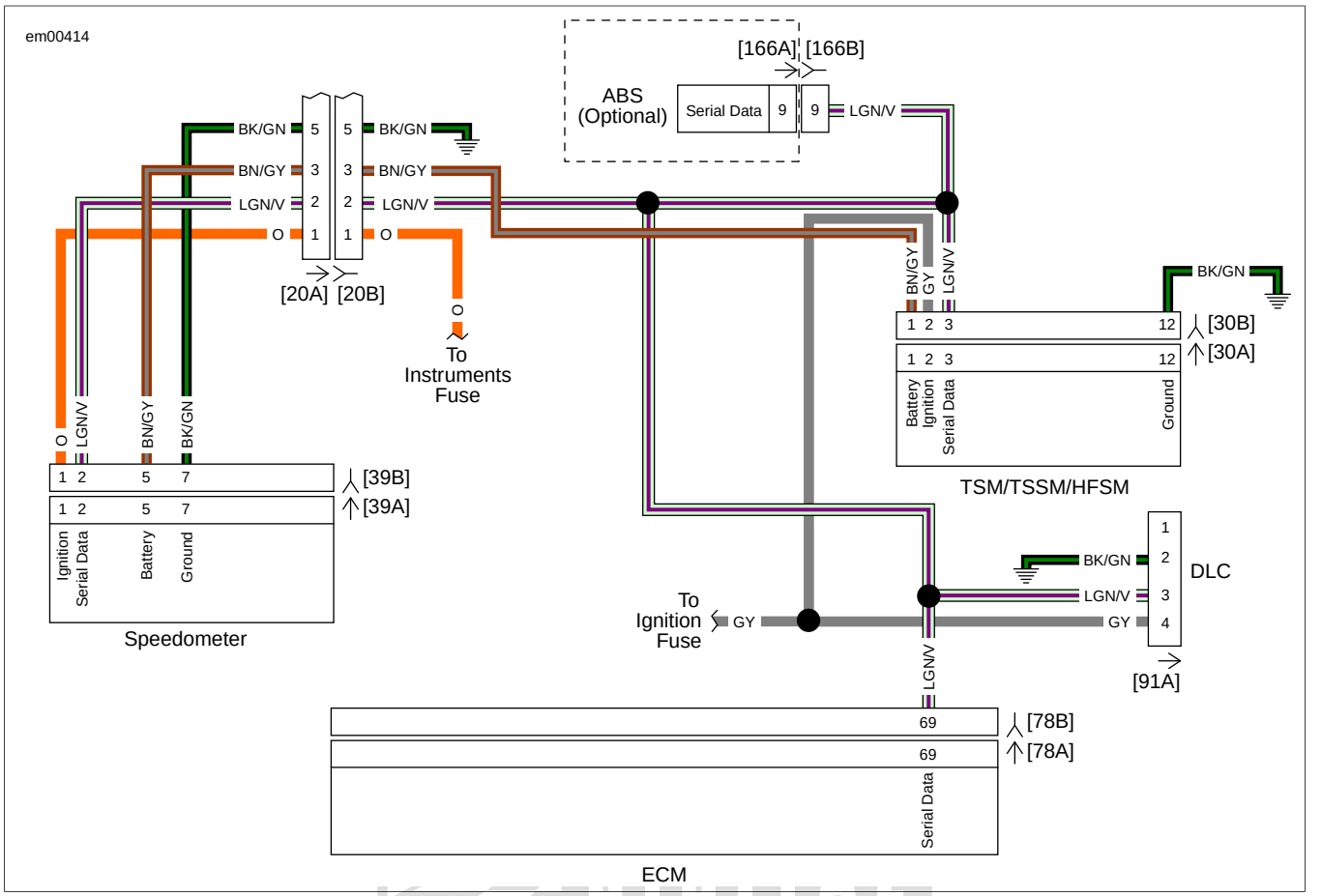
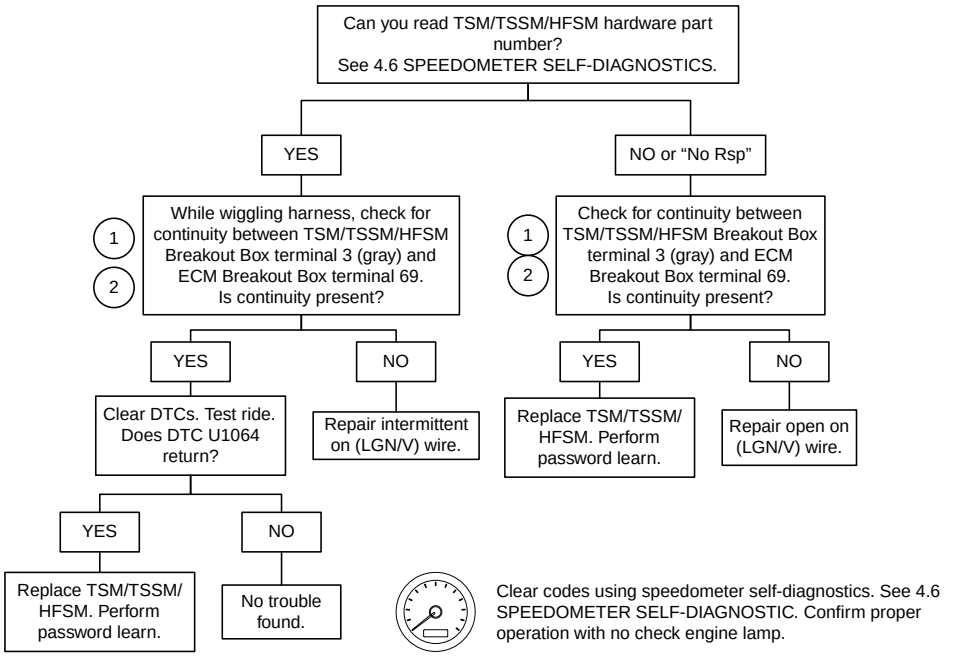


Figure 4-83. ECM and TSM/TSSM/HFSM Circuit (FLHR/C)

Table 4-84. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	16-place Molex	Under seat
[30]	TSM/TSSM/HFSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Packard	Under console (back of speedometer)
[78]	ECM	73-place Delphi	Under seat
[91]	DLC	4-place Deutsch	Under left side cover
[166]	ABS module	20-place Molex	Under right side cover

DTC U1064



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DTC U1097 4.46

GENERAL

Loss of Speedometer Serial Data

The serial data connector provides a means for the speedometer, ECM, and TSM/TSSM/HFSM to communicate their current status. When all operating parameters on the serial data link are within specifications, a state of health message is sent between the components. DTC U1097 indicates that the speedometer is not capable of sending this state of health message. DTC U1097 also indicates that there was communication on the data bus since power up, but communication was lost or interrupted during that key cycle.

Table 4-85. Code Description

DTC	DESCRIPTION
U1097	Loss of all speedometer serial data (state of health)

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-46601	INSTRUMENT HARNESS ADAPTERS
HD-48637	BREAKOUT BOX
HD-48637	BREAKOUT BOX

NOTE

If DTC is historic and not current, wiggle wire harness while performing voltage and continuity tests to identify intermittents.

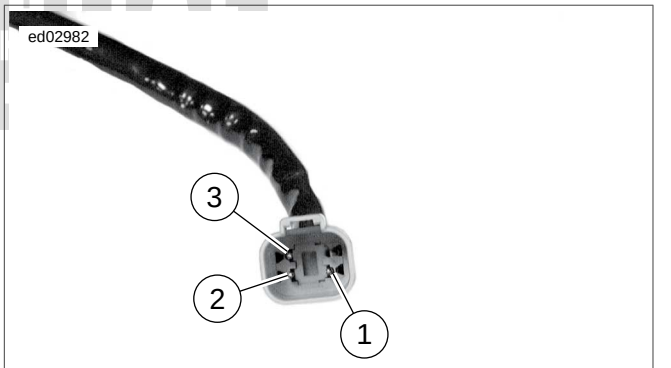
Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Mate black pin housing on BREAKOUT BOX (Part No. HD-48637) with wire harness connector [39B] using INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601). Leave speedometer [39A] disconnected.
2. Connect BREAKOUT BOX (Part No. HD-48637) to wire harness connector [78B]. Leave ECM connector [78A] disconnected. See 4.7 BREAKOUT BOX: EFI.



Figure 4-84. ECM DLC



1. **Terminal 2: ground (BK/GN)**
2. **Terminal 3: serial data (LGN/V)**
3. **Terminal 4: power (GY)**

Figure 4-85. Data Link Connector

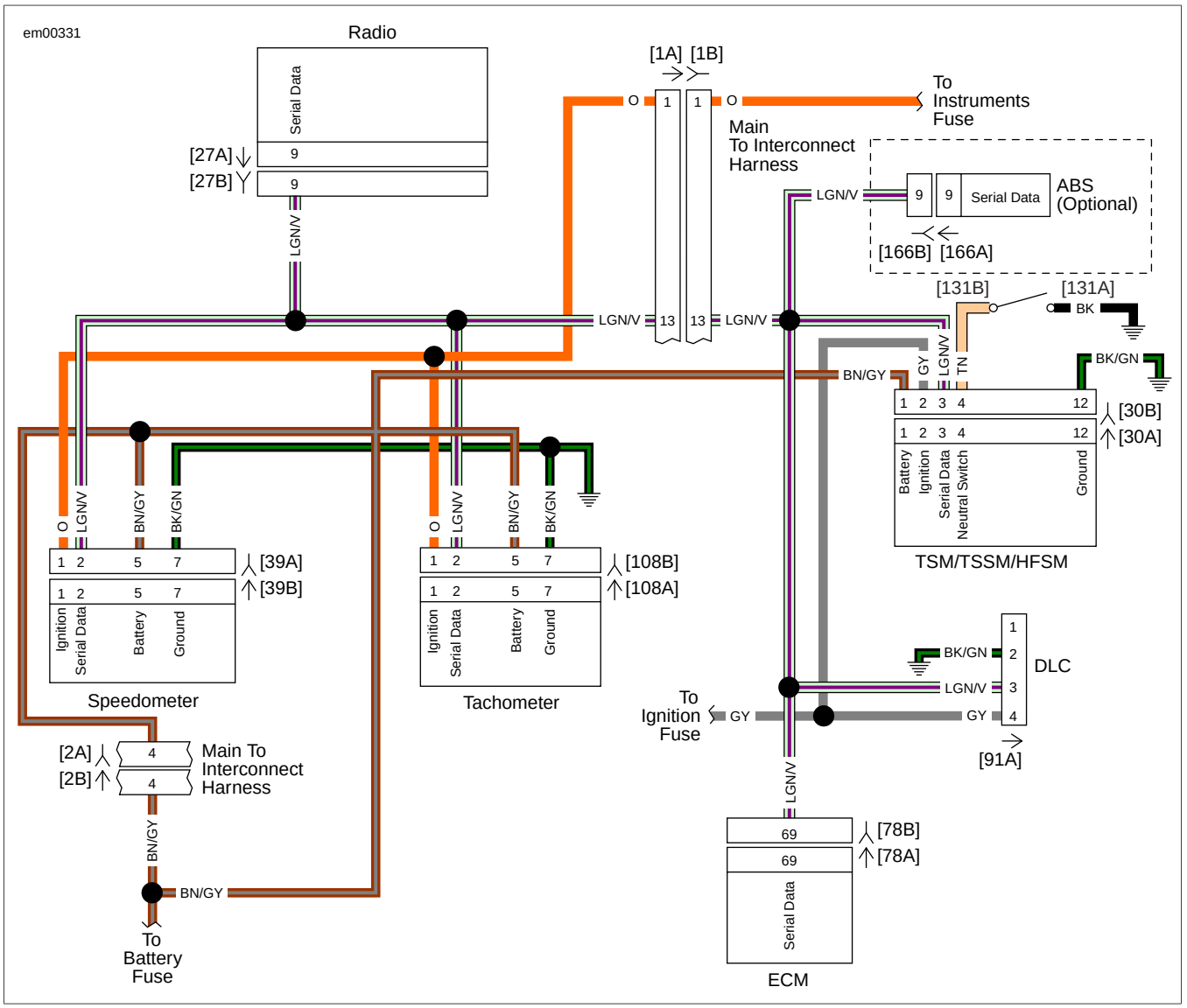


Figure 4-86. Serial Data Circuit (FLHX, FLHT/C/U, FLTR)

Table 4-86. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (black)	Inner fairing - right side (below radio)
[2]	Main to interconnect harness	All	12-place Molex (gray)	Inner fairing - left radio support bracket
[27]	Radio	All	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[30]	TSM/TSSM/HFSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHT/C	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
[78]	ECM	All	73-place Delphi	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover
[108]	Tachometer	FLHT/C	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)

Table 4-86. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[131]	Neutral switch	All	Post terminals	Top of transmission (right side)
[166]	ABS module	All	20-place Molex	Under right side cover

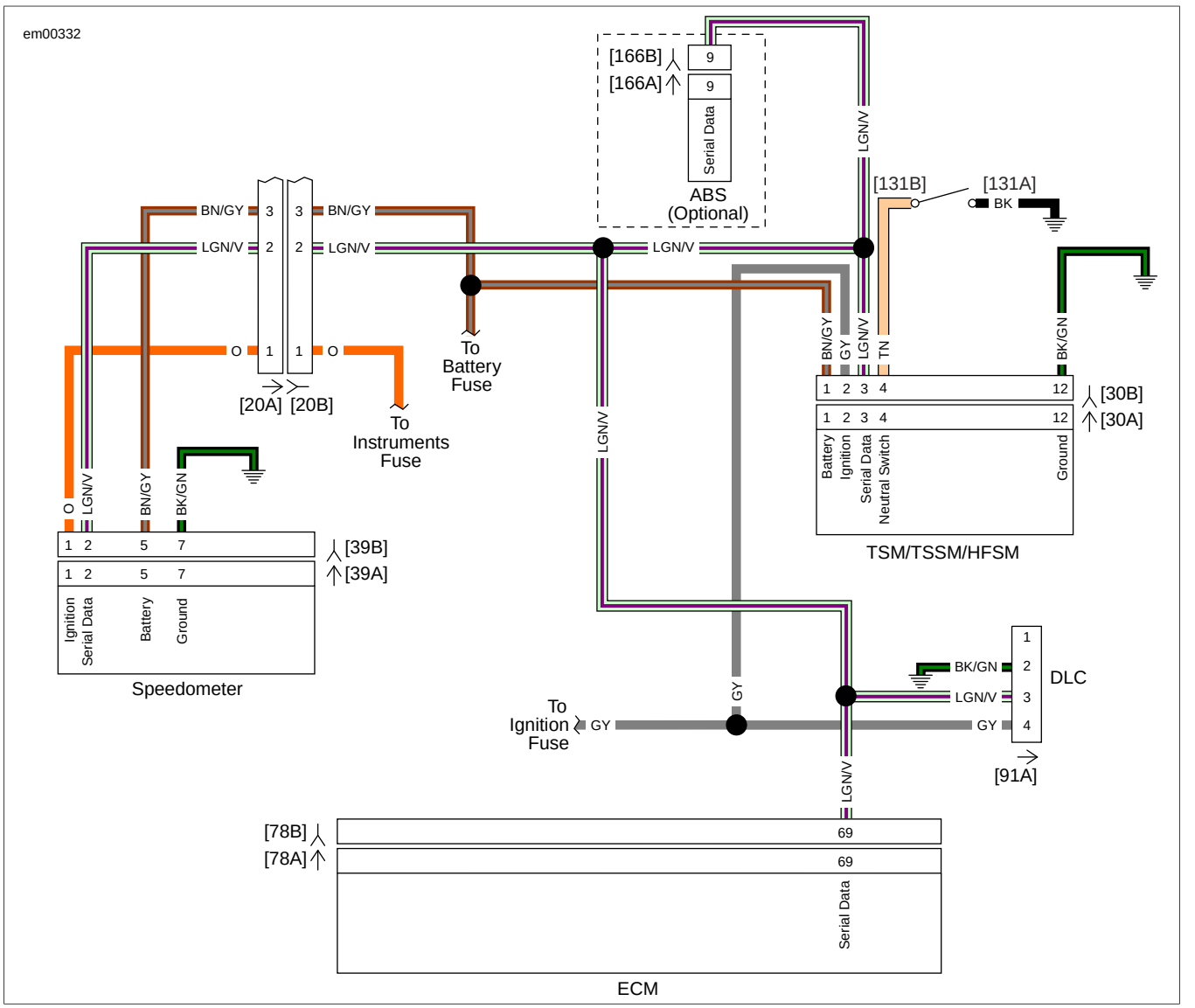


Figure 4-87. Serial Data Circuit (FLHR/C)

Table 4-87. Wire Harness Connectors

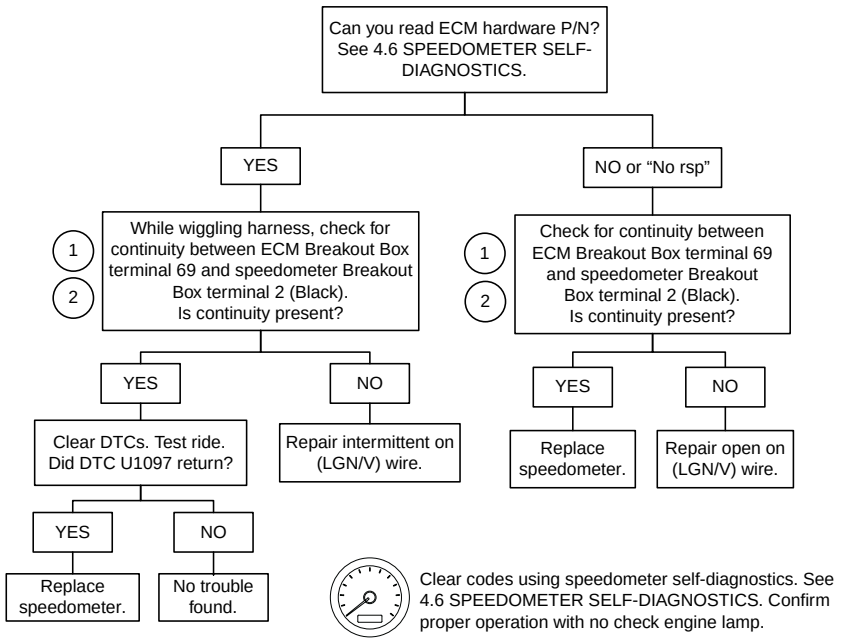
NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	16-place Molex	Under seat
[30]	TSM/TSSM/HFSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Packard	Back of speedometer (back of console)
[78]	ECM	73-place Delphi	Under seat

Table 4-87. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[91]	DLC	4-place Deutsch	Under left side cover
[131]	Neutral switch	Post terminals	Top of transmission (right side)
[166]	ABS module	20-place Molex	Under right side cover

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC U1097



DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FUEL PRESSURE TEST 4.47

GENERAL

The fuel pump delivers fuel through the fuel line to a cavity in the induction module. This cavity directs the fuel to the fuel injectors and pressure regulator. The pressure regulator controls the fuel pressure by passing excess fuel back to the fuel tank. Improper fuel pressure may contribute to one of the following symptoms:

- cranks, but won't run
- cut out (may feel like ignition problem)
- hesitation, loss of power, or poor fuel economy

If incorrect fuel pressure is suspected, perform a fuel pressure test. See the service manual for the required tools and procedure for performing a fuel pressure test.

DIAGNOSTICS

Perform a fuel pressure test. See the service manual. The fuel pressure should remain steady between 55-62 PSI (380-425 KPa). If pressure does not hold steady, follow either the low fuel pressure or high fuel pressure procedure, depending on the symptom.

Low Fuel Pressure

1. Check the fuel filter or pump inlet screen for restrictions. If the concern is found, clean the pump inlet screen or replace the fuel filter.
2. If the concern was not corrected, inspect for a:

- restricted pressure line or flex hose between the fuel tank and the test gauge.
- faulty fuel pump.
- restricted check valve fitting assembly.
- leak inside the tank caused by faulty coupling hose or connection, such as a hose at the filter or pump. This condition can be identified, if the fuel level in the tank is low, by a ringing sound inside the tank during the first 2 seconds after key on. This is caused by the high pressure fuel spraying against the inside of the tank.
- faulty fuel pressure regulator.

Once the concern is located, repair as needed.

High Fuel Pressure

1. Inspect the check valve fitting assembly and the fuel tank. If the concern is found correct as needed.
2. If the concern was not corrected, replace the fuel regulator.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

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NOTES

RADIO DIAGNOSTICS 5.1

SYSTEM DESCRIPTION

Harley-Davidson's Advanced Audio System, developed in partnership with Harman/Kardon, offers improved function and sound quality with an all new integrated design. The base radio features six AM and ten FM radio presets, integrated weather band, and a single disc CD player compatible with CD/CDR/CDRW and MP3 format discs. The system also allows for seamless hook up of optional accessories (both current and future) to the base radio display and hand controls.

The Advanced Audio System consists of the following components:

- Radio
- CB module
- Antennas (radio and CB)
- Fairing, rear and sidecar speakers, depending upon model
- Handlebar, rear and sidecar switches, depending upon model
- High Output Amplifier. Standard on 2009 sidecar equipped Ultra Classic, CVO Ultra Classic and also as an optional accessory; located under the luggage rack
- Optional accessory Bluetooth Hands-Free cell phone interface module and antenna; located inside Tour-Pak
- Optional accessory XM satellite radio module and antenna; located in fairing above radio
- Optional accessory navigation module and external antenna; module plugs into radio chassis in fairing
- Future accessory connector.

ONBOARD DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

General

The system has onboard diagnostics to detect most fault conditions. Many faults are stored as diagnostic trouble codes (DTCs). Fault conditions that do not generate DTCs, or those for which DTCs cannot be read, can be identified by their symptoms. For troubleshooting and resolving switch inoperative without DTC conditions, as well as other symptoms, see 5.5 ADVANCED AUDIO SYSTEM SYMPTOMS.

Radio Diagnostic Display

Press the eject button to remove any CD in the unit. Then, while pressing and holding any two softkeys (buttons 1-6), turn the ignition switch ON. Once the H-D logo is displayed, the system automatically performs a complete switch check, scans for current DTCs, and then displays the radio diagnostic display. Release the softkeys only after the radio diagnostic display appears. See A of Figure 5-1.

If, after the intial diagnostic check, any switches are found to be shorted to B+ or ground, the radio diagnostic display reports the applicable DTC and an abbreviated description. Refer to the appropriate flowchart for resolution of the problem. See B of Figure 5-1.

If no switches are found to be shorted to B+ or ground, the technician may press selected switches to verify functionality. If a switch is functioning properly, the display shows the switch name and the word "OK." If the switch is not working correctly, then the display does not change. All switches, handlebar, passenger, and sidecar may be tested in this manner. See C of Figure 5-1.

Pressing softkey 1 while in the radio diagnostic display sets the system back to the factory defaults. See D of Figure 5-1. If a symptom is present without a DTC, restoring the factory default settings may sometimes resolve the issue. For more information, see 5.5 ADVANCED AUDIO SYSTEM SYMPTOMS.

Pressing softkey 2 displays "Speed Pulses" followed by a speed pulse value. This feature may be employed to quickly verify whether the radio is configured correctly or whether the AVC or J1850 is working properly.

To use this feature, start the motorcycle, access the radio diagnostic display, press softkey 2 to select AVC, and then walk or push the motorcycle while viewing the speed pulse value. If a value other than zero appears, it is an indication that J1850 and AVC are working properly. If speed pulses are not present, either the AVC needs to be reconfigured or another problem exists. Refer to DTC U1016 for resolution of the problem if the system is configured correctly. See E of Figure 5-1.

Pressing softkey 3 displays the region and other configuration data, while softkey 4 shows the software version code. See F and G of Figure 5-1.

Softkey 5 is reserved for software upgrades and prompts the technician to install the appropriate CD, while softkey 6 causes the system to exit the radio diagnostic mode and revert to the normal radio display.

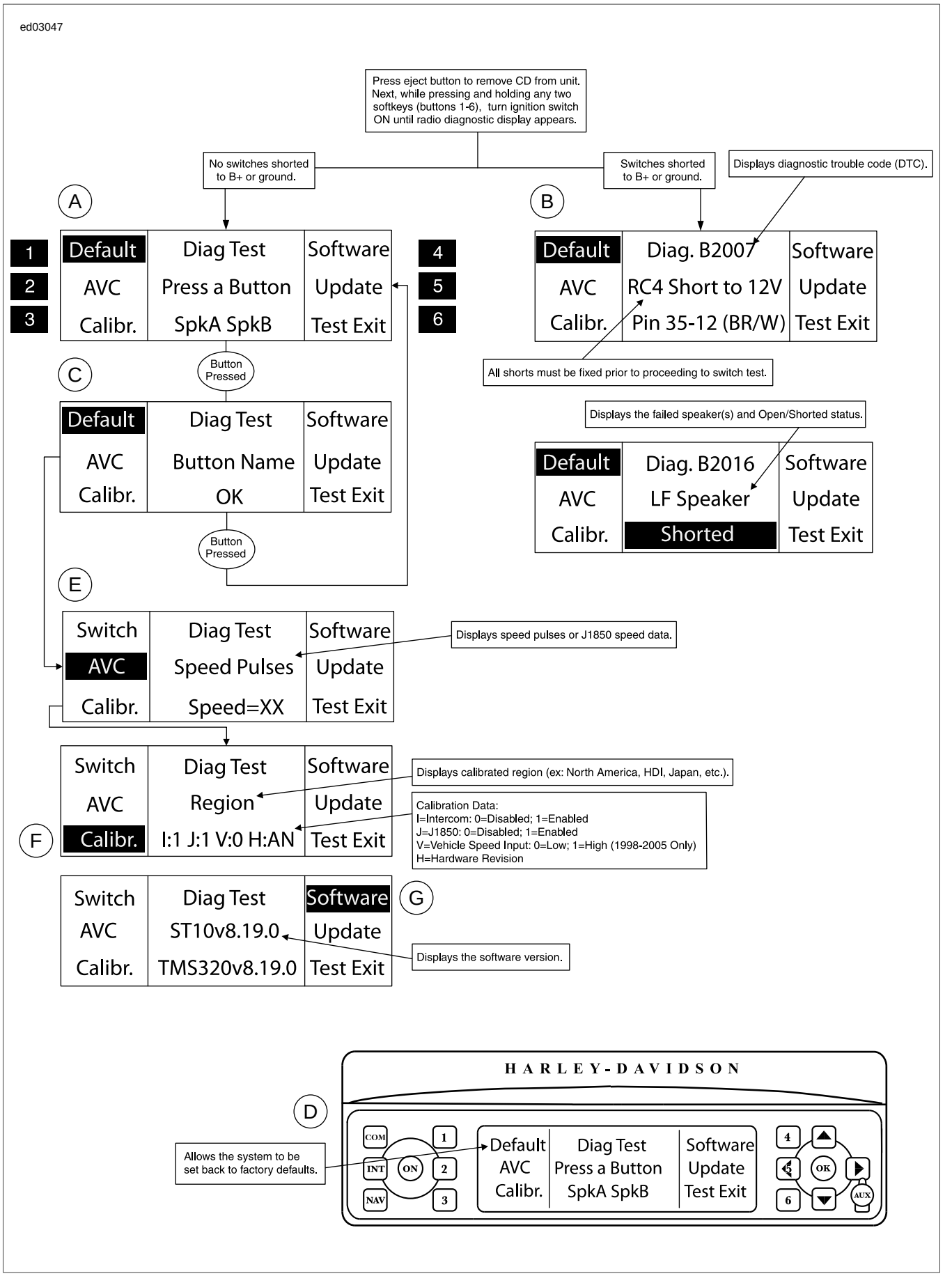


Figure 5-1. Initial Diagnostics - Radio Diagnostic Display

Table 5-1. Diagnostic Trouble Codes (DTCs) and Symptoms

DTC	DESCRIPTION	FAULT-SET CONDITION	FAULT-CLEAR CONDITION T=TIME; R=RESISTANCE
B0563	Battery voltage high	t>=15 sec. V>= 16 Volts	Normal range for t>=15 seconds
B2006	Radio switch stuck or open	t>=15 sec.	Normal range for t>=15 seconds
B2007	Handlebar switch shorted high	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	Normal range for t>=15 seconds*
B2008	Handlebar switch shorted low	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	Normal range for t>=15 seconds*
B2009	Handlebar switch stuck or open	t>=15 sec.	Normal range for t>=15 seconds
B2010	Passenger switch shorted high	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	Normal range for t>=15 seconds*
B2011	Passenger switch shorted low	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	Normal range for t>=15 seconds*
B2012	Passenger switch stuck or open	t>=15 sec.	Normal range for t>=15 seconds
B2013	Sidecar switch shorted high	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	Normal range for t>=15 seconds
B2014	Sidecar switch shorted low	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	Normal range for t>=15 seconds
B2015	Sidecar switch stuck or open	t>=15 sec.	Normal range for t>=15 seconds
B2016	Front speakers shorted	R<1.5 Ohms tested once per ignition cycle R>TBD when setup as line out ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	R>1.5 Ohms tested once per ignition cycle
B2017	Front speakers open	R>100 Ohms tested once per ignition cycle ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	R<100 Ohms tested once per ignition cycle
B2018	Front speakers shorted to ground	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	
B2019	Front speakers shorted to battery	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	
B2020	Rear speakers shorted	R<1.5 Ohms tested once per ignition cycle R>TBD when setup as line out ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	R>1.5 Ohms tested once per ignition cycle
B2021	Rear speakers open	R>100 Ohms tested once per ignition cycle ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	R<100 Ohms tested once per ignition cycle
B2022	Rear Speakers shorted to ground	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	
B2023	Rear speakers shorted to battery	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	
B2024	Sidecar speakers shorted	R<1.5 Ohms tested once per ignition cycle R>TBD when setup as line out ignition ON or run diagnostics, t=instantaneous	R>1.5 Ohms tested once per ignition cycle
B2025	Sidecar speakers open	R>100 Ohms tested once per ignition cycle ignition ON or run diagnostics, t=instantaneous	R<100 Ohms tested once per ignition cycle
B2026	Sidecar speakers shorted to ground	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	

Table 5-1. Diagnostic Trouble Codes (DTCs) and Symptoms

DTC	DESCRIPTION	FAULT-SET CONDITION	FAULT-CLEAR CONDITION T=TIME; R=RESISTANCE
B2027	Sidecar speakers shorted to battery	Ignition ON after Ignition OFF for at least 10 sec., t=instantaneous	
* Ignition ON after Ignition OFF for at least 10 seconds.			

Table 5-2. Diagnostic Trouble Codes (DTCs) and Symptoms

DTC/SYMPTOM	DESCRIPTION	GO TO
U1016	J1850 lost communications with ECM	DTC 1304 through DTC 1317 can only be viewed as historic codes using DIGITAL TECHNICIAN II (Part No. HD-48650). The faults are detectable as current codes only if they happen to occur while in the diagnostic mode. To diagnose these conditions without the use of DIGITAL TECHNICIAN II (Part No. HD-48650), see 5.5 ADVANCED AUDIO SYSTEM SYMPTOMS.
U1300	J1850 bus shorted low	
U1301	J1850 bus shorted high	
U1302	Infotainment bus off error	
U1304	Infotainment bus lost communications with future	
U1305	Infotainment bus lost communications with future	
U1306	Infotainment bus lost communications with hands-free phone module	
U1307	Infotainment bus lost communications with CB	
U1308	Infotainment bus lost communications with future	
U1309	Infotainment bus lost communications with future	
U1310	Infotainment bus lost communications with future	
U1311	Infotainment bus lost communications with future	
U1312	Infotainment bus lost communications with future	
U1313	Infotainment bus lost communications with XM	
U1314	Infotainment bus lost communications with navigation	
U1315	Infotainment bus lost communications with future	
U1316	Infotainment bus lost communications with future	
U1317	Infotainment bus lost communications with high output amplifier	
1	Radio Inoperative	Radio Inoperative: Symptom 1
2	Poor or No Reception	Poor or No Reception: Symptom 2
3	Static Present With Engine Running	Static Present With Engine Running: Symptom 3
4	CB Transmitter Inoperative and SWR Adjustment	CB Transmitter Inoperative: Symptom 4 (Part 1 of 4)
5	CB Receiver Inoperative	CB Receiver Inoperative: Symptom 5 (Part 1 of 3)
6	Intercom Inoperative	Intercom Inoperative: Symptom 6

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Table 5-2. Diagnostic Trouble Codes (DTCs) and Symptoms

DTC/SYMPTOM	DESCRIPTION	GO TO
7	Handheld Microphone/PTT Inoperative	Handheld Microphone/PTT Inoperative: Symptom 7 (Part 1 of 2)
8	Speaker Switch Malfunction	Speaker Switch Malfunction: Symptom 8
9	Headset Speakers Inoperative	Headset Speakers Inoperative: Symptom 9 (Part 1 of 5)
10	No or Low Audio From Microphones	No or Low Audio From Microphones: Symptom 10 (Part 1 of 4)
11	No or Low Audio With High Output Amplifier	No or Low Audio With High Output Amplifier: Symptom 11 (Part 1 of 2)
12	No or Low Audio From XM or XM Inoperative	No or Low Audio From XM or XM Inoperative: Symptom 12 (Part 1 of 2)
13	XM - No or Intermittent Reception	XM - No or Intermittent Reception: Symptom 13
14	Navigation Inoperative	Navigation Inoperative: Symptom 14 (Part 1 of 2)
15	AVC Inoperative	AVC Inoperative: Symptom 15
16	Handlebar, Passenger or Sidecar Switches Inoperative	Handlebar, Passenger or Sidecar Switches Inoperative: Symptom 16 (Part 1 of 4)
17	CD Skipping	CD Skipping: Symptom 17
18	Hands-Free Phone Module Inoperative No or Low Audio To Hands-Free Phone Module No or Low Audio From Hands-Free Phone Module Hands-Free Phone Module - Phone Not Pairing	Hands-Free Phone Module Initial Diagnostics: Symptom 18 (Part 1 of 5)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B2006-B2015, RADIO SWITCH DIAGNOSTICS 5.2

GENERAL

The sound system is designed to capture faults for each of the radio switch inputs. When a fault is detected, a DTC is generated. Refer to Table 5-3. The DTC and related data appears on the radio display when the system is in the diagnostic mode.

Table 5-3. Code Description

DTC	DESCRIPTION
B2006	Radio switch stuck or open
B2007	Handlebar switch shorted high
B2008	Handlebar switch shorted low
B2009	Handlebar switch stuck or open
B2010	Passenger switch shorted high
B2011	Passenger switch shorted low
B2012	Passenger switch stuck or open
B2013	Sidecar switch shorted high
B2014	Sidecar switch shorted low
B2015	Sidecar switch stuck or open

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-47918	RADIO BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Install RADIO BREAKOUT BOX (Part No. HD-47918)
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray socket probes and patch cord.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown socket probes and patch cord.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown pin probe and patch cord.

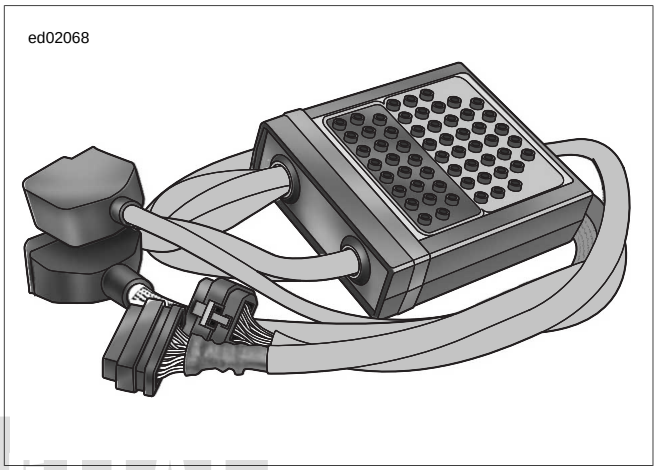
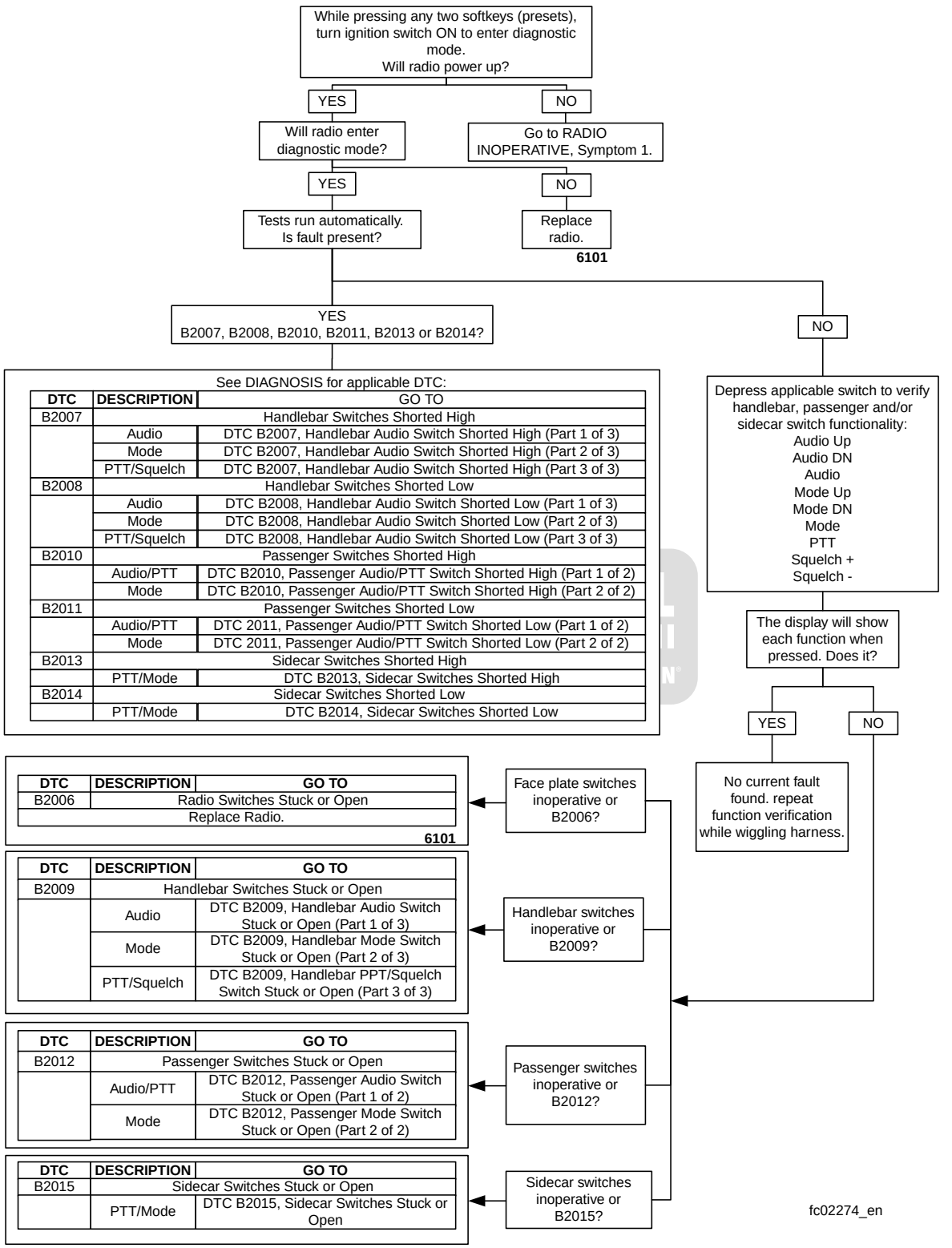


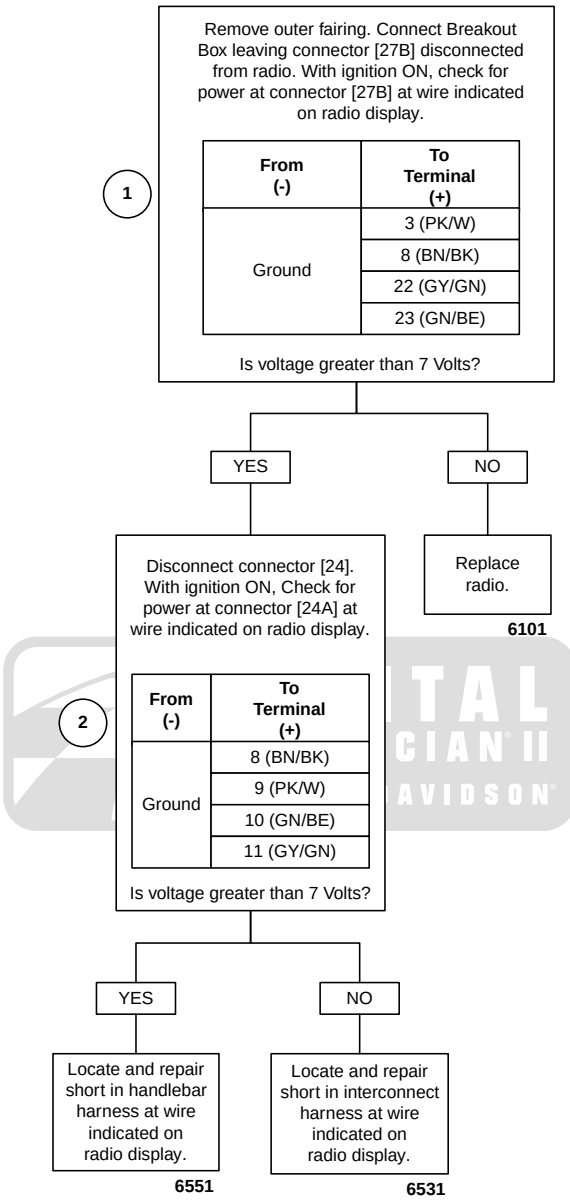
Figure 5-2. Radio Breakout Box (Part No. HD-47918)

BLUE TECHNICIAN II HARLEY-DAVIDSON

DTC B2006 through B2015



DTC B2007, Handlebar Audio Switch Shorted High (Part 1 of 3)





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

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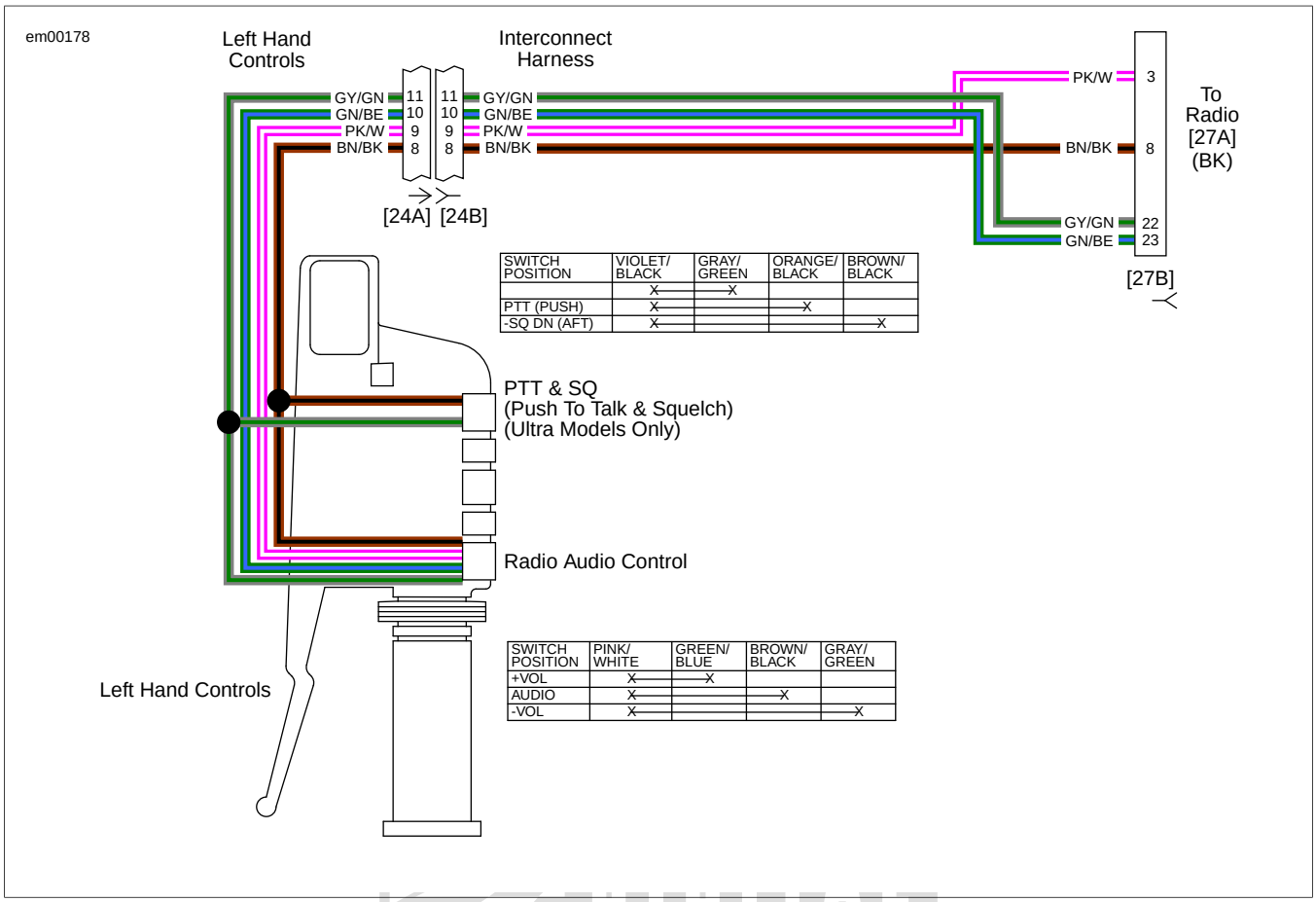
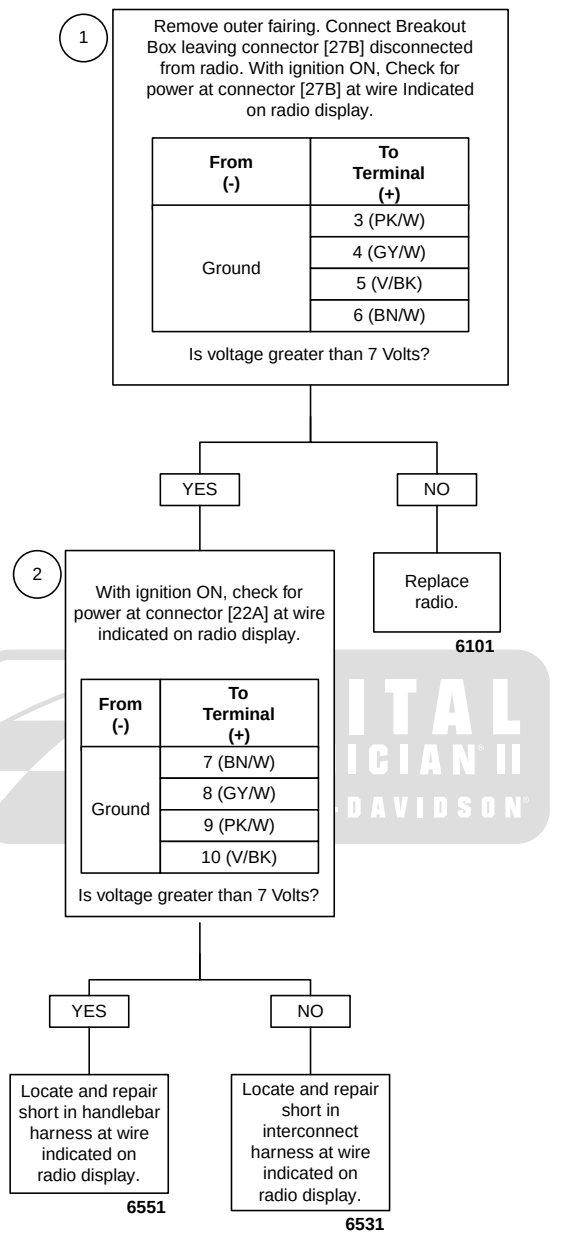


Figure 5-3. Handlebar Audio Switch Circuit

Table 5-4. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[24]	Interconnect harness to left handlebar switches	16-Place Molex (Gray)	FLHX, FLHTC/U - Inner fairing - left fairing support brace FLTR - Inner fairing - left side of radio bracket
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)

DTC B2007, Handlebar Mode Switch Shorted High (Part 2 of 3)



Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

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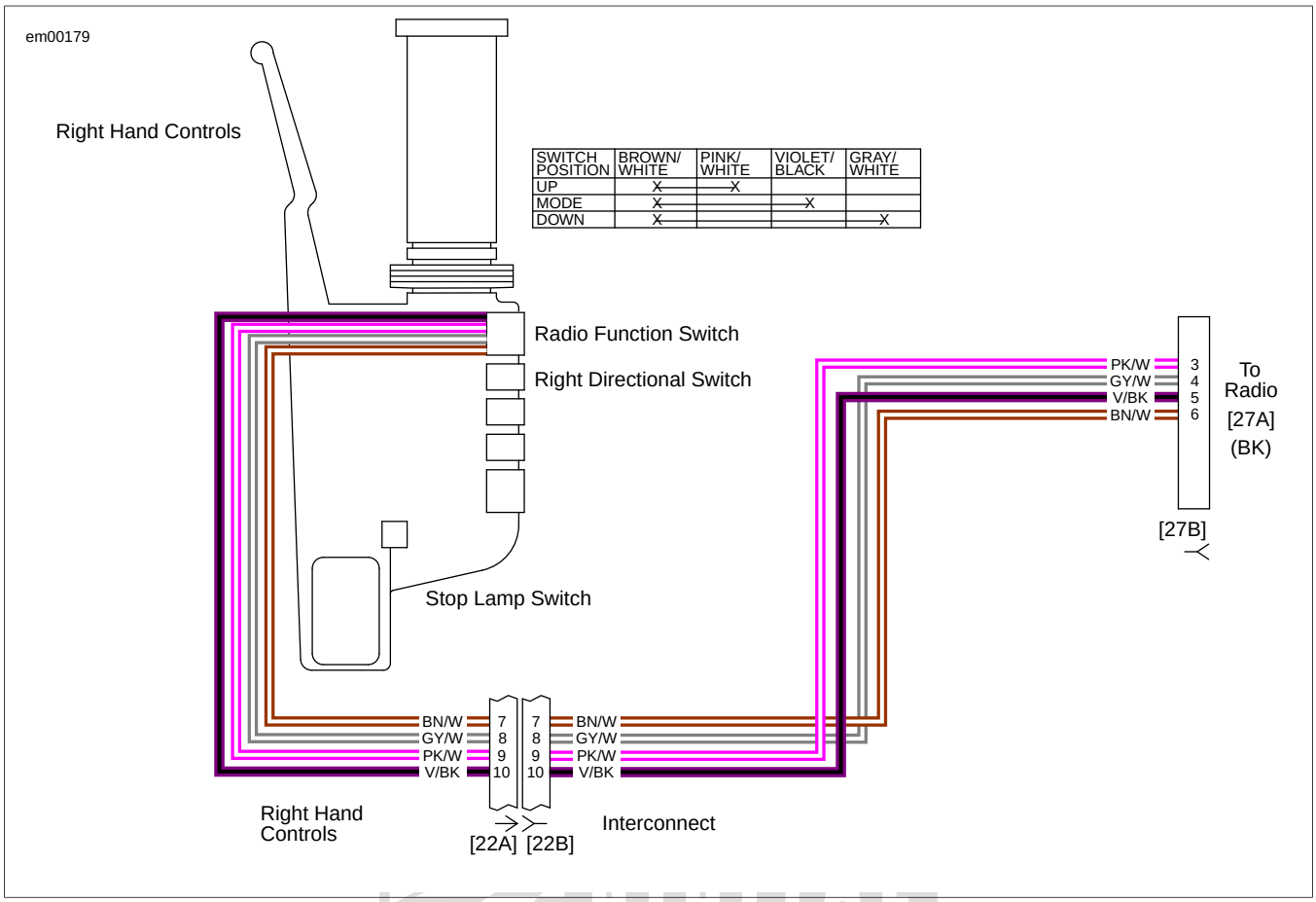
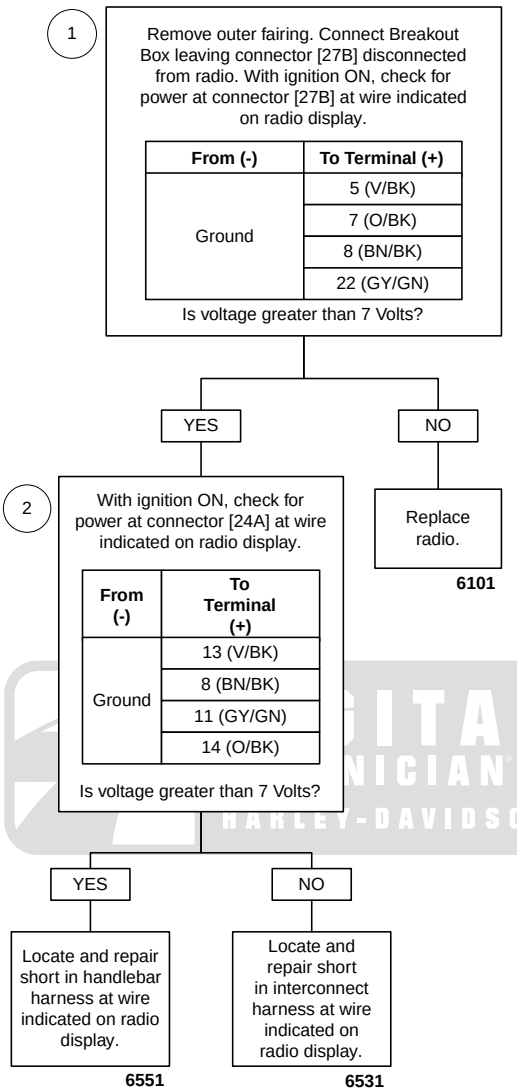


Figure 5-4. Handlebar Mode Switch Circuit

Table 5-5. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Interconnect harness to right handlebar switches	12-place Molex (Black)	FLHX, FLHTC/U - Inner fairing - right fairing support brace FLTR - Inner fairing - left side of radio bracket
[27]	Radio	23-place Amp (Tyco)	Inner fairing - back of radio (right side)

DTC B2007, Handlebar PTT/Squelch Switch Shorted High (Part 3 of 3)



Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

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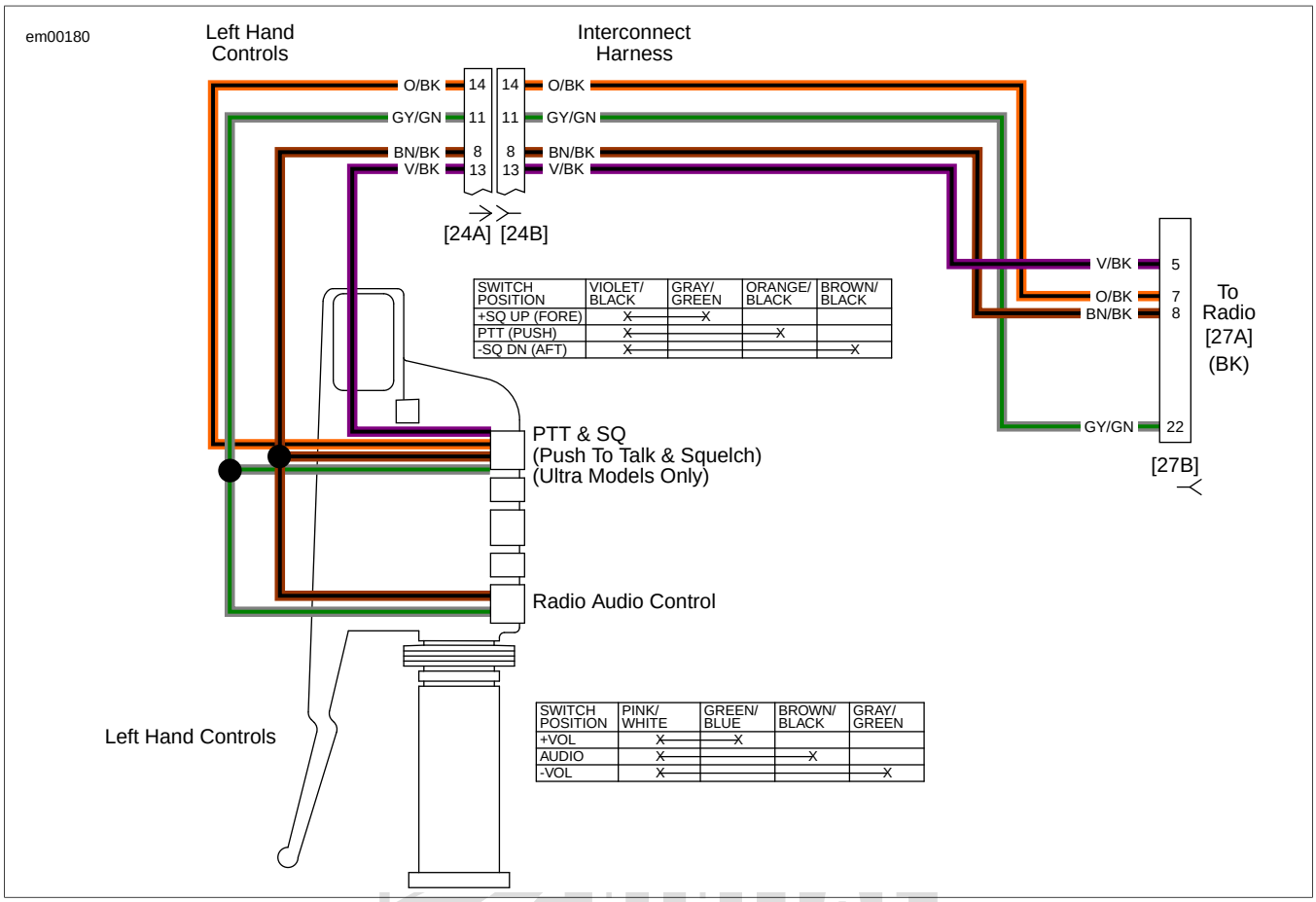
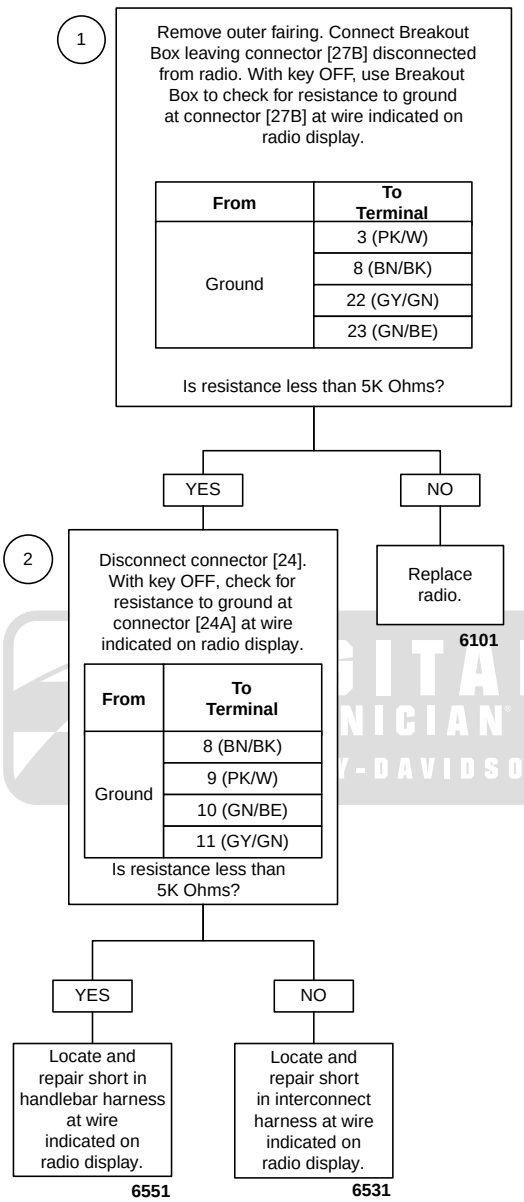


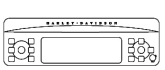
Figure 5-5. Handlebar PTT/Squelch Switch Circuit

Table 5-6. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[24]	Interconnect harness to left handlebar switches	16-Place Molex (Gray)	FLHX, FLHTC/U - Inner fairing - left fairing support brace FLTR - Inner fairing - left side of radio bracket
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)

DTC B2008, Handlebar Audio Switch Shorted Low (Part 1 of 3)





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

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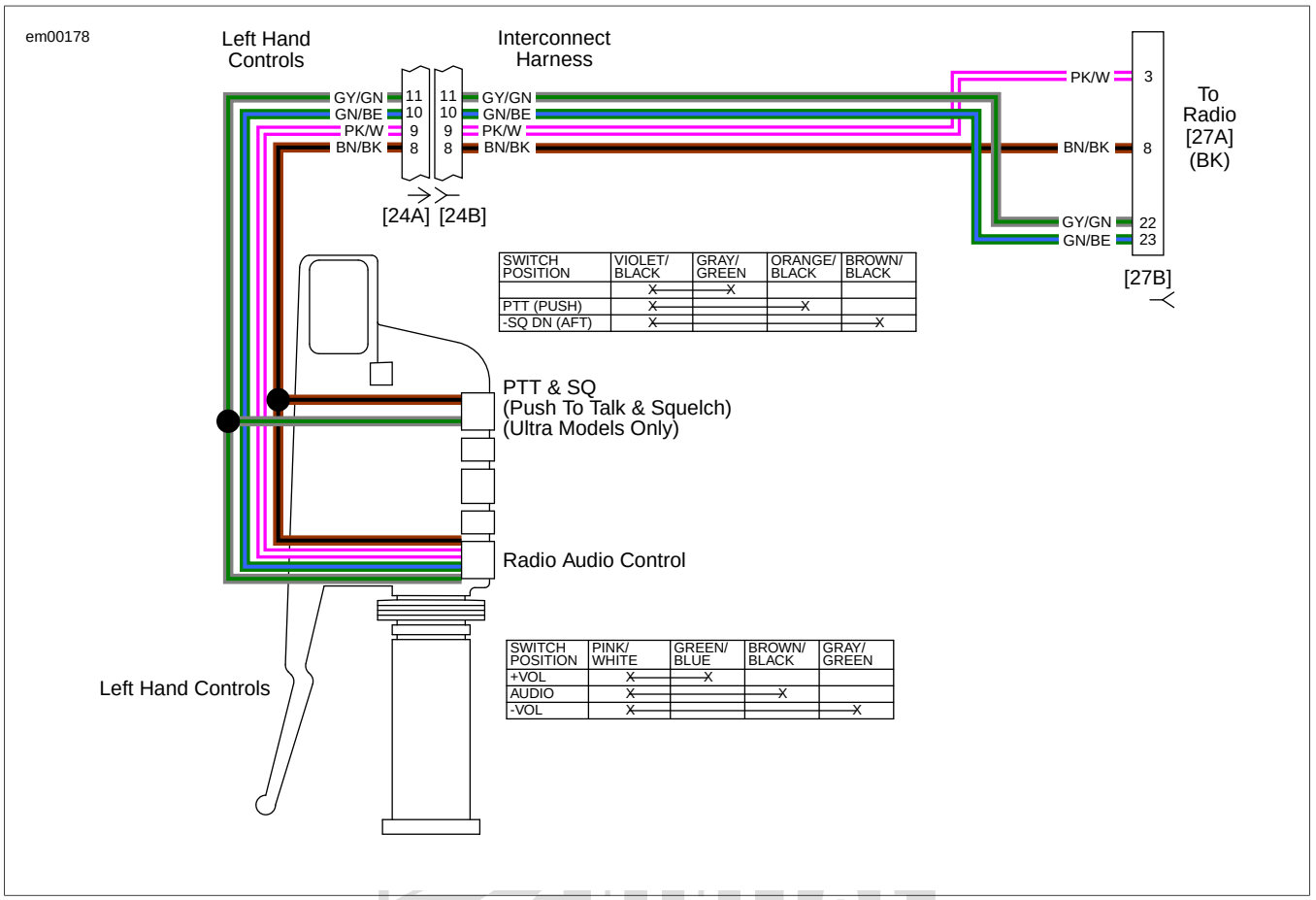
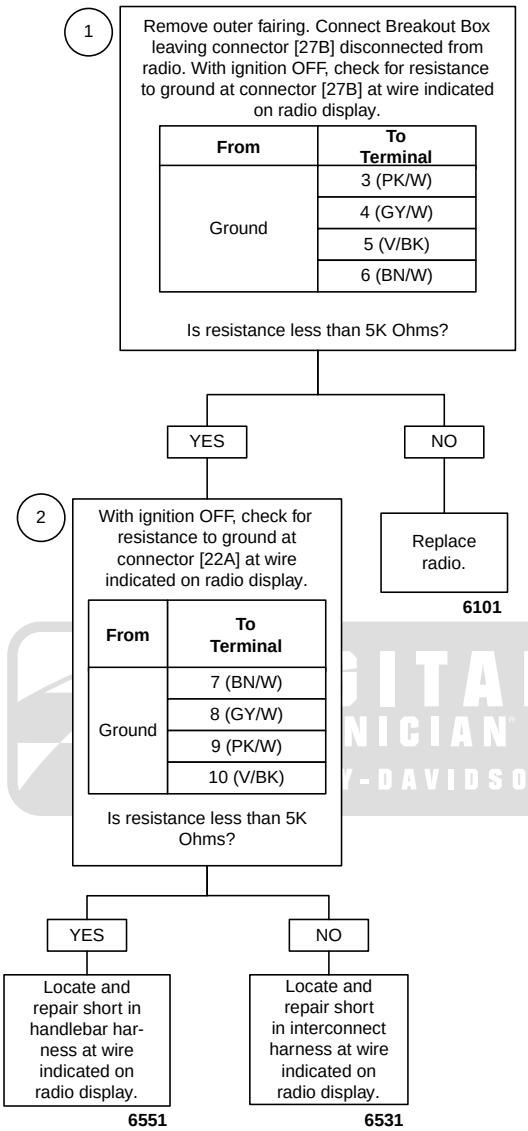


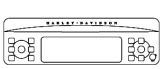
Figure 5-6. Handlebar Audio Switch Circuit

Table 5-7. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[24]	Interconnect harness to left handlebar switches	16-Place Molex (Gray)	FLHX, FLHTC/U - Inner fairing - left fairing support brace FLTR - Inner fairing - left side of radio bracket
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)

DTC B2008, Handlebar Mode Switch Shorted Low (Part 2 of 3)





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

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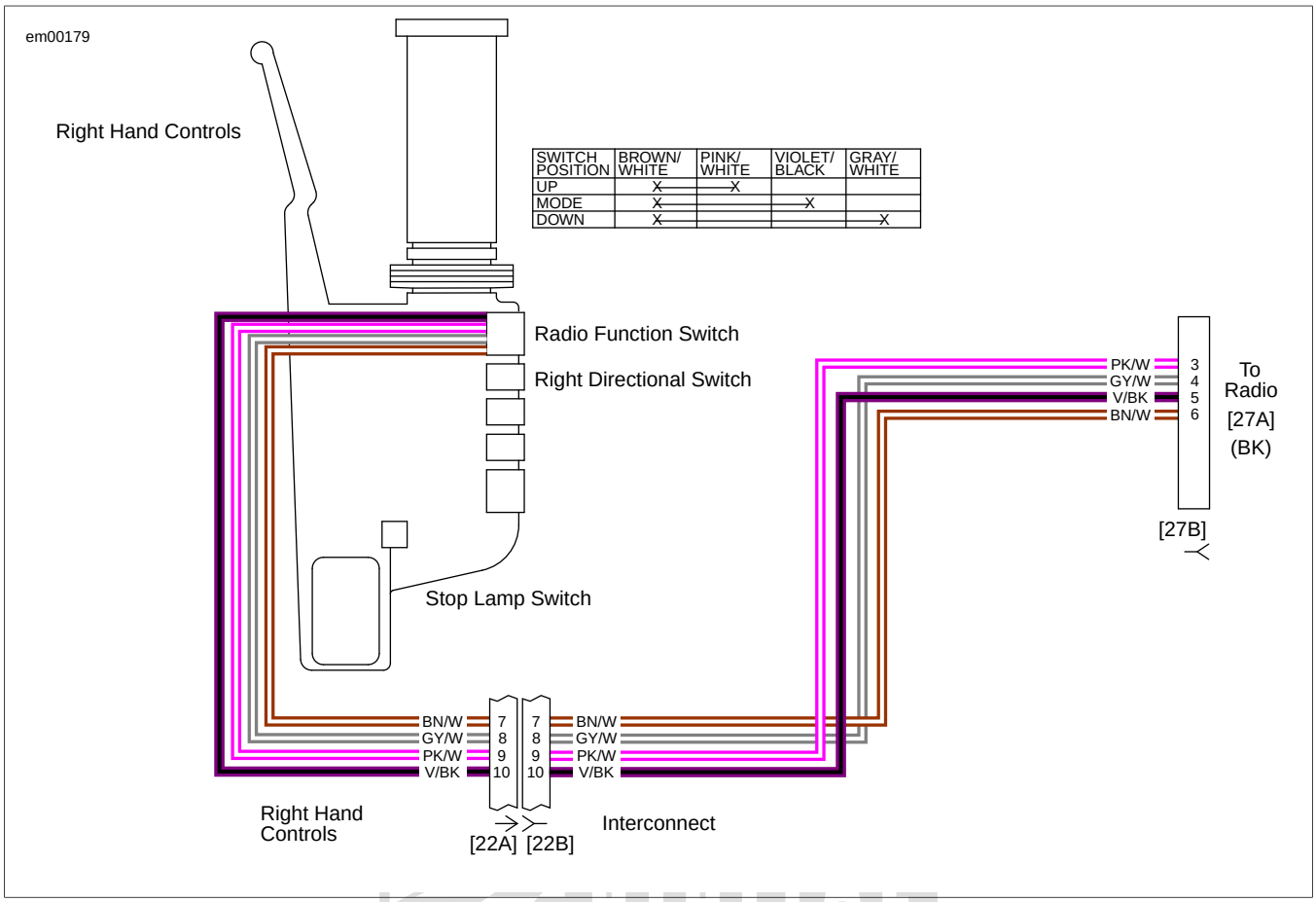
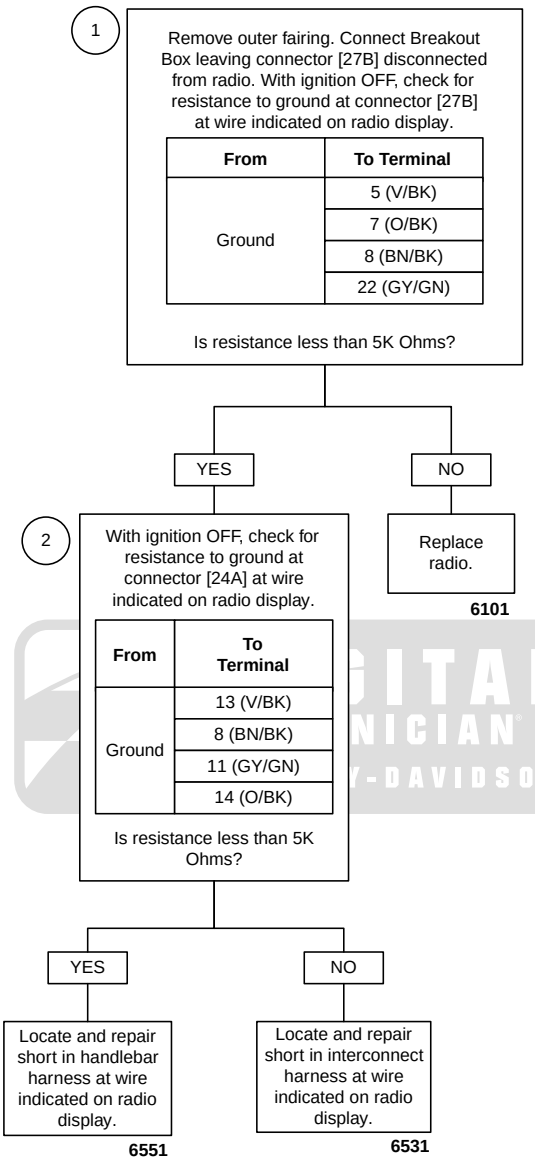


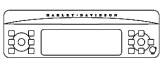
Figure 5-7. Handlebar Mode Switch Circuit

Table 5-8. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Interconnect harness to right handlebar switches	12-place Molex (Black)	FLHX, FLHTC/U - Inner fairing - right fairing support brace FLTR - Inner fairing - left side of radio bracket
[27]	Radio	23-place Amp (Tyco)	Inner fairing - back of radio (right side)

DTC B2008, Handlebar PTT/Squelch Switch Shorted Low (Part 3 of 3)





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02280_en

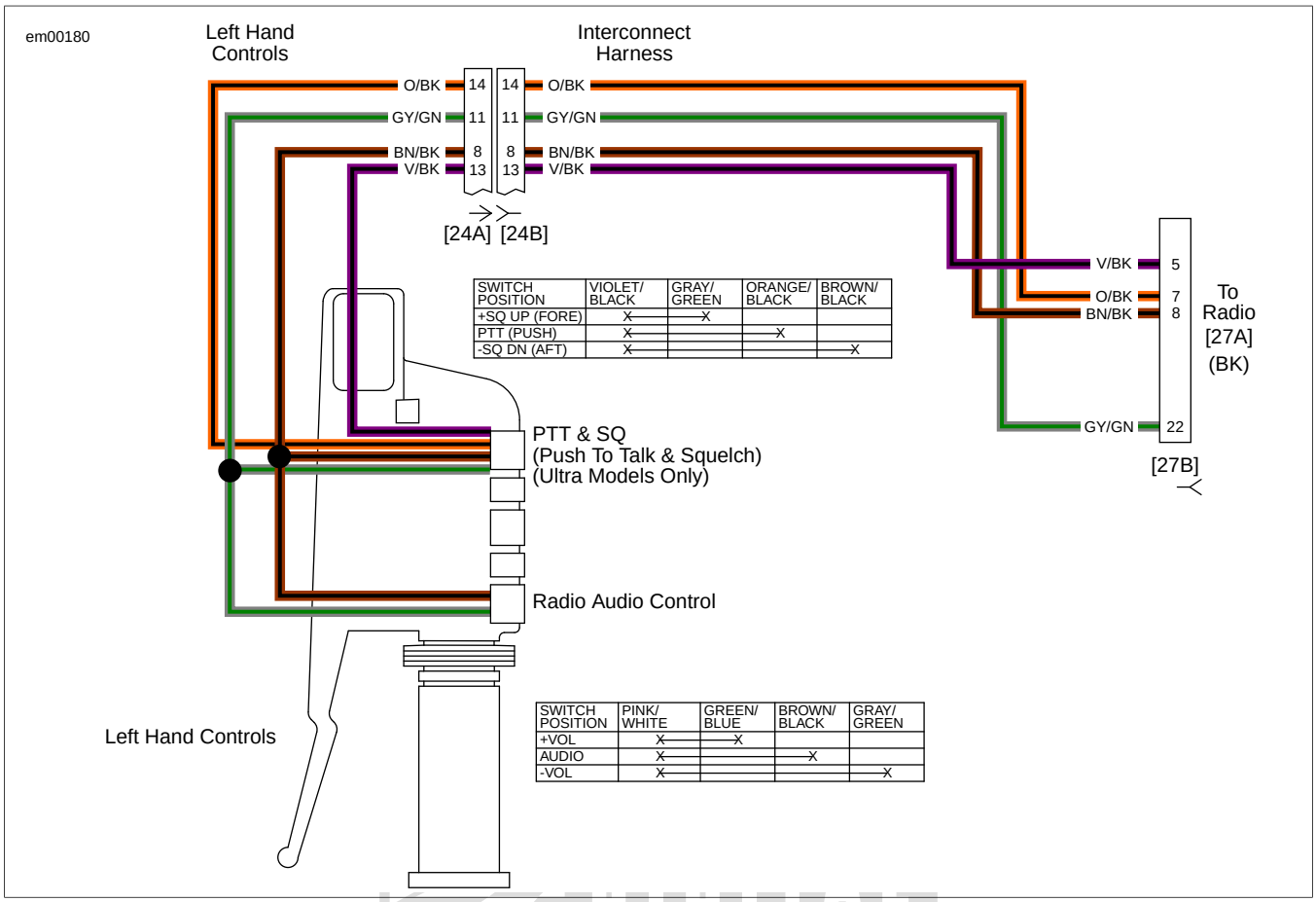
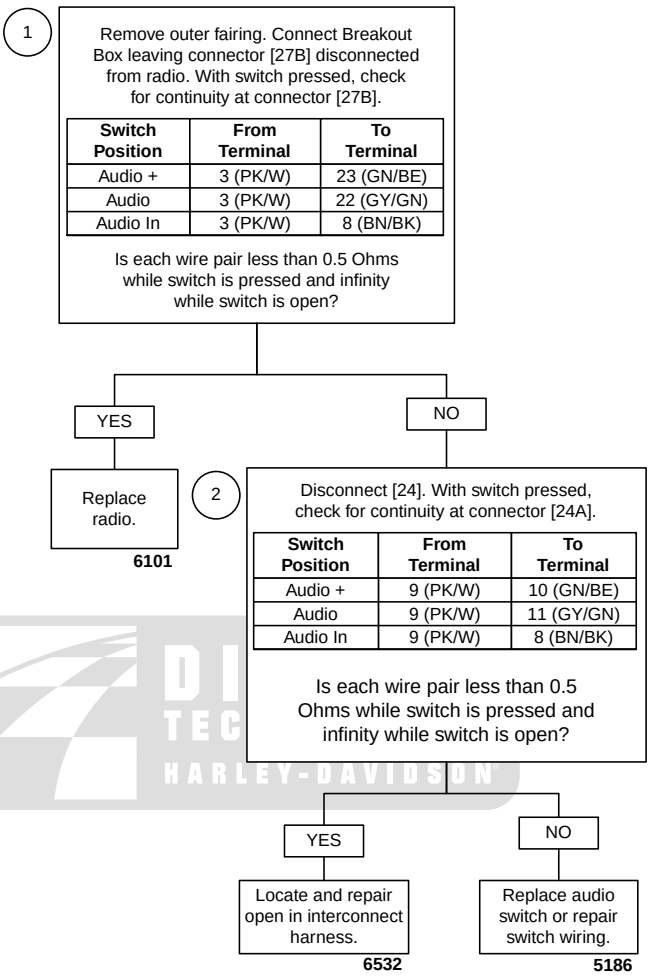


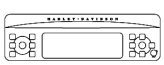
Figure 5-8. Handlebar PTT/Squelch Switch Circuit

Table 5-9. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[24]	Interconnect harness to left handlebar switches	16-Place Molex (Gray)	FLHX, FLHTC/U - Inner fairing - left fairing support brace FLTR - Inner fairing - left side of radio bracket
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)

DTC B2009, Handlebar Audio Switch Stuck or Open (Part 1 of 3)





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02281_en

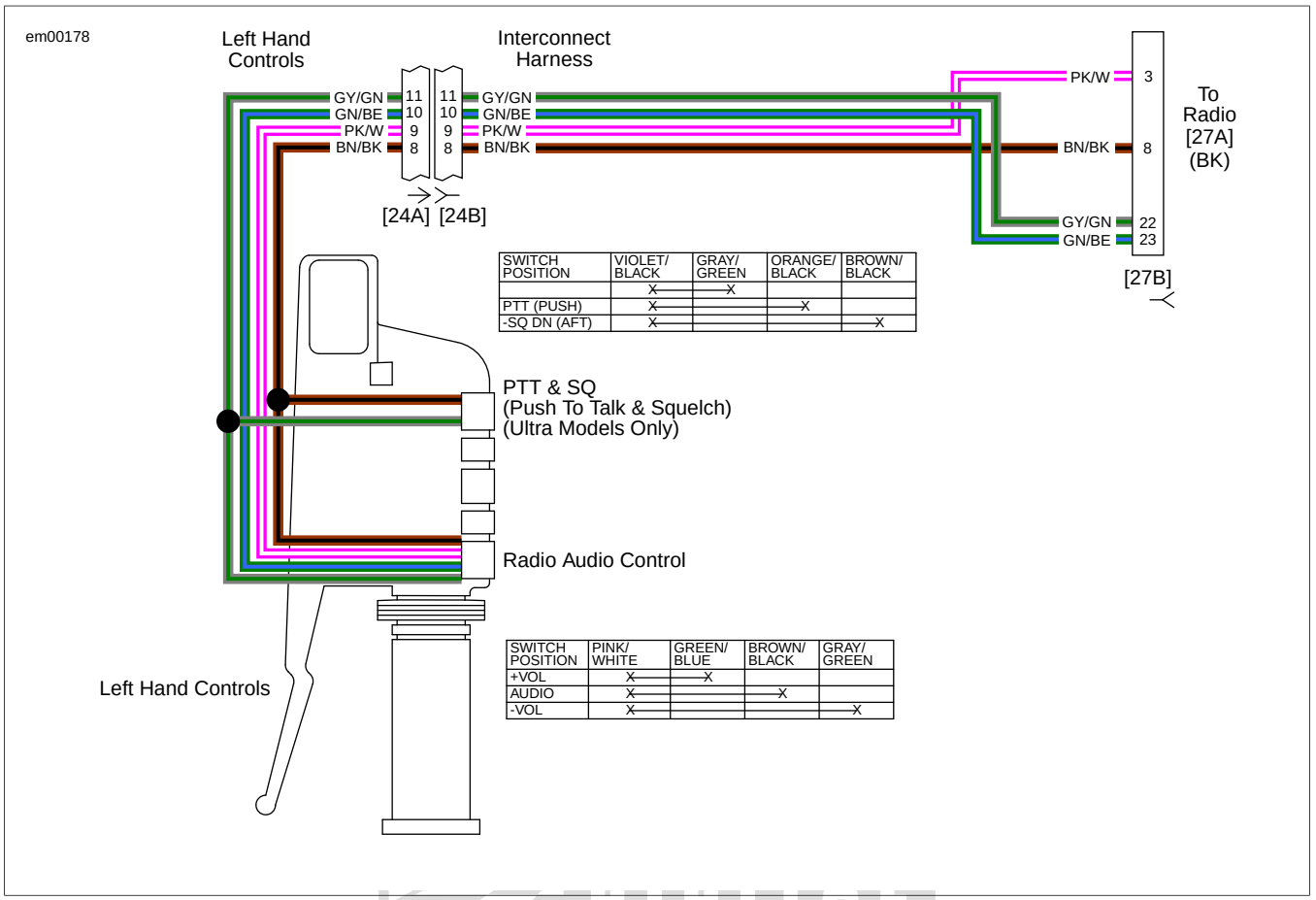
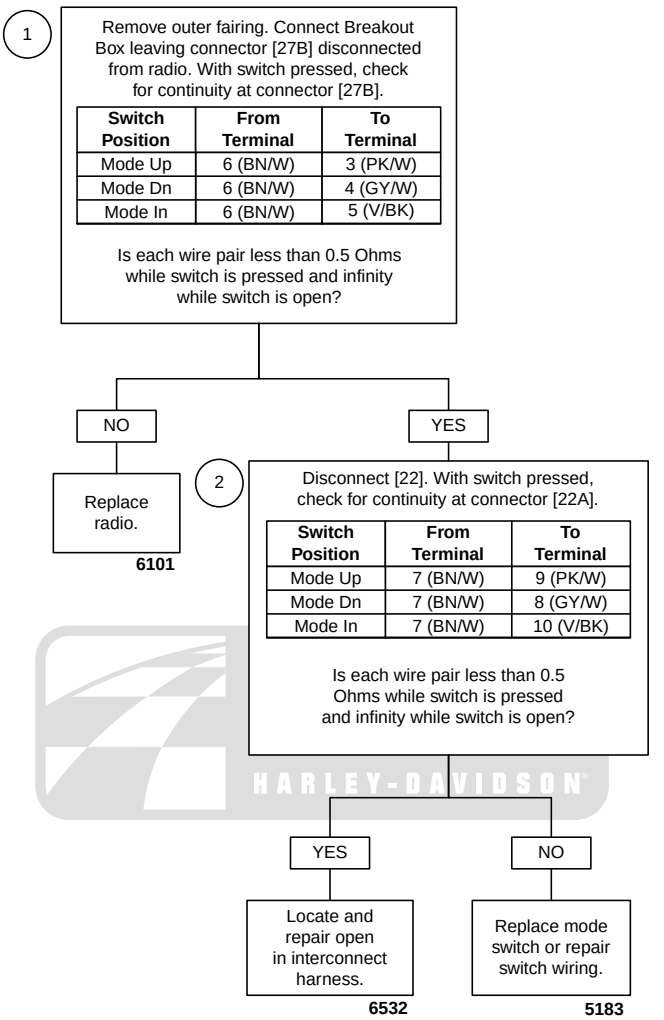


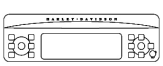
Figure 5-9. Handlebar Audio Switch Circuit

Table 5-10. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[24]	Interconnect harness to left handlebar switches	16-Place Molex (Gray)	FLHX, FLHTC/U - Inner fairing - left fairing support brace FLTR - Inner fairing - left side of radio bracket
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)

DTC B2009, Handlebar Mode Switch Stuck or Open (Part 2 of 3)





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02282_en

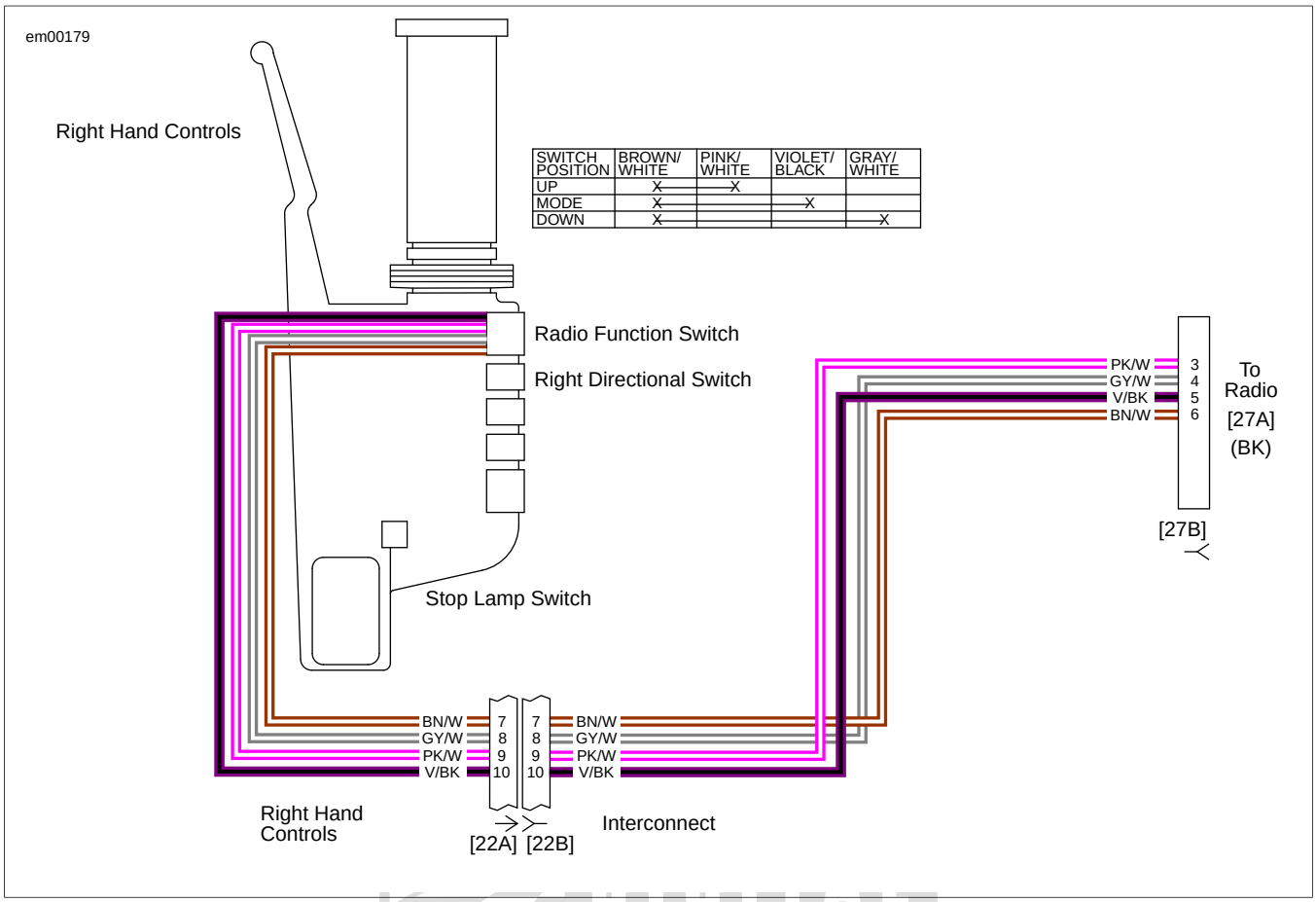
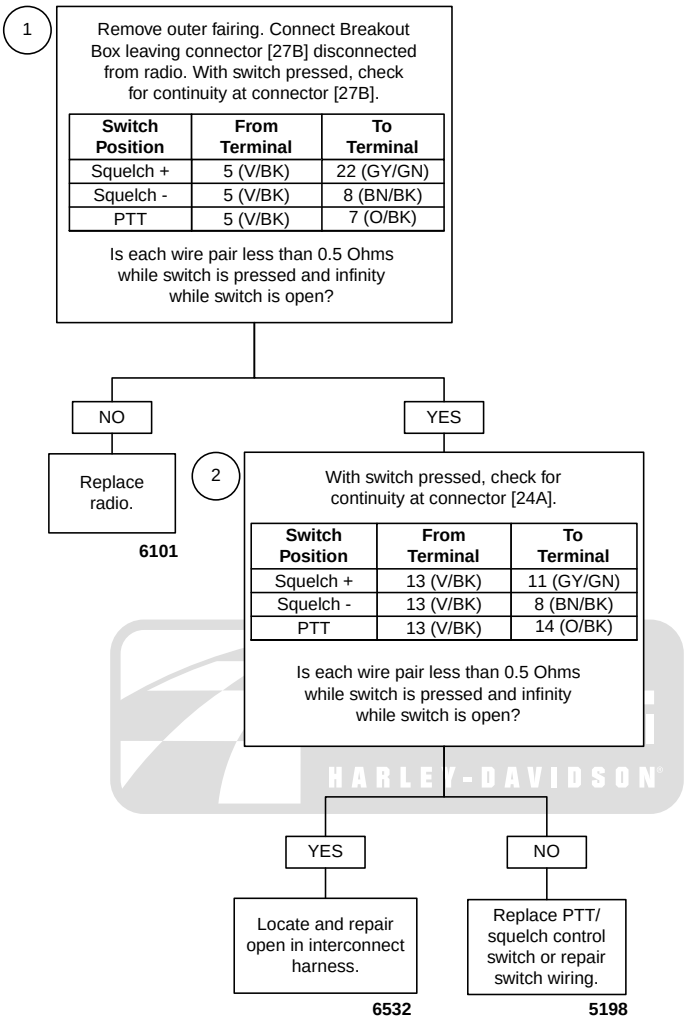


Figure 5-10. Handlebar Mode Switch Circuit

Table 5-11. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Interconnect harness to right handlebar switches	12-place Molex (Black)	FLHX, FLHTC/U - Inner fairing - right fairing support brace FLTR - Inner fairing - left side of radio bracket
[27]	Radio	23-place Amp (Tyco)	Inner fairing - back of radio (right side)

DTC B2009, Handlebar PTT/Squelch Switch Stuck or Open (Part 3 of 3)



Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02283_en

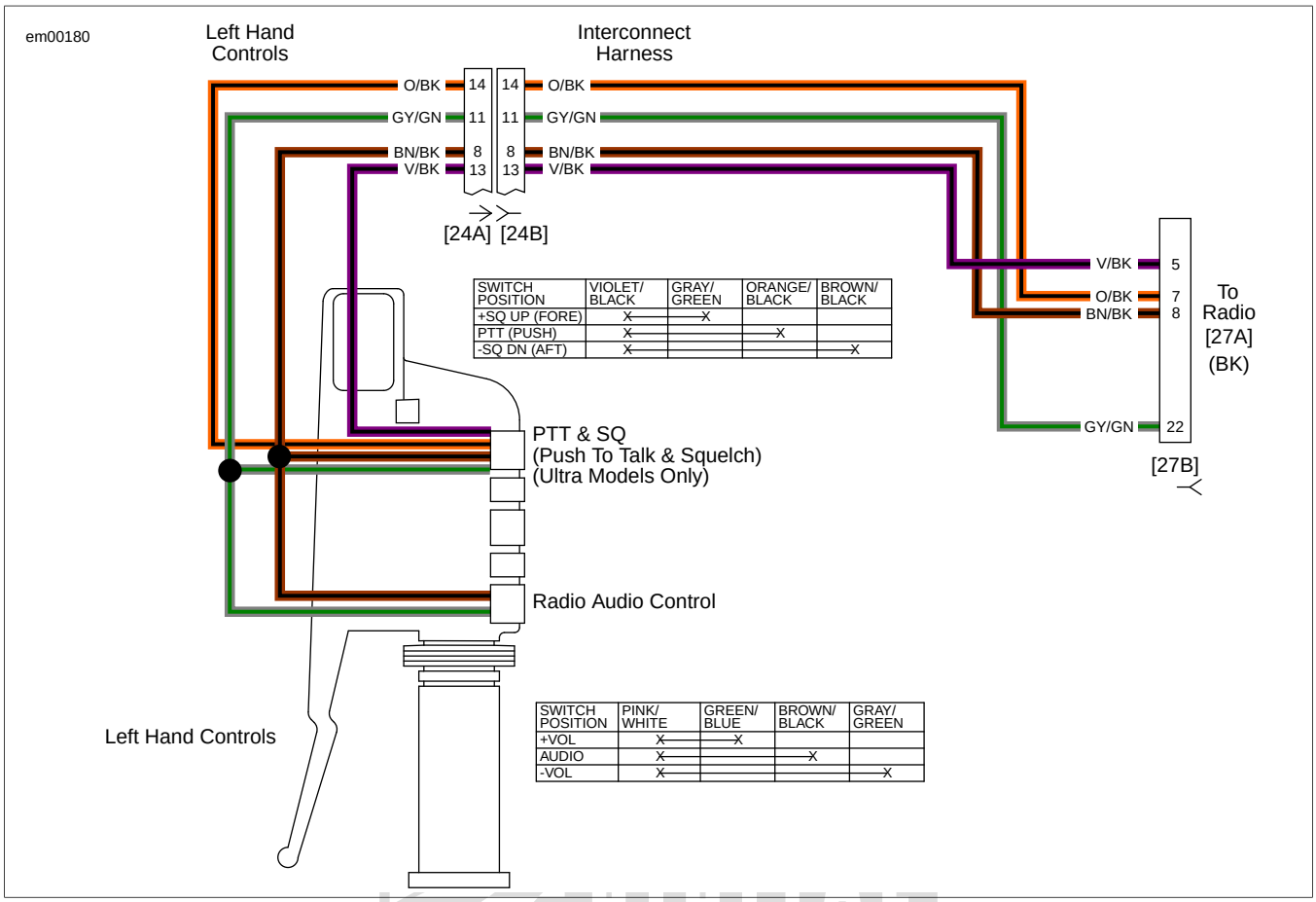
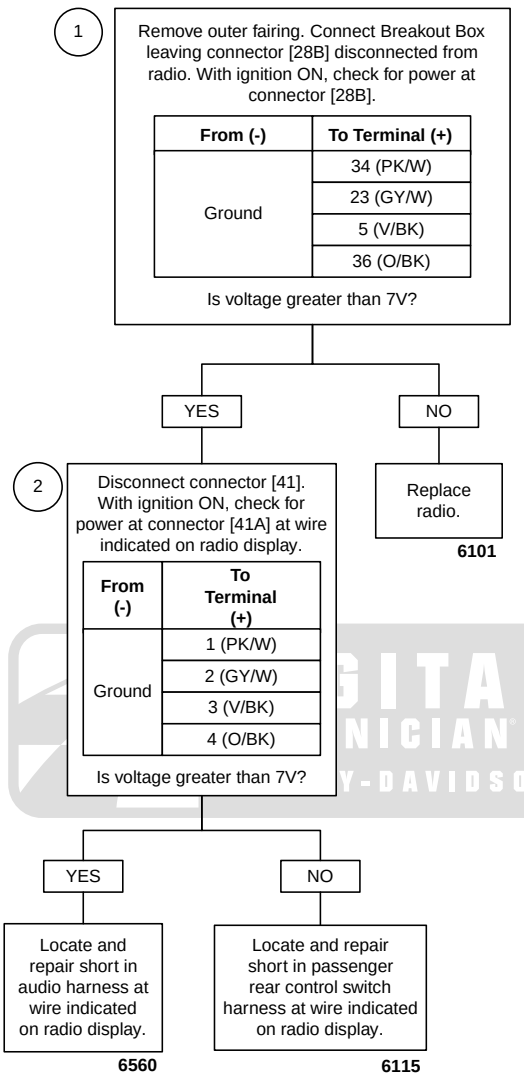


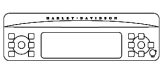
Figure 5-11. Handlebar PTT/Squelch Switch Circuit

Table 5-12. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[24]	Interconnect harness to left handlebar switches	16-Place Molex (Gray)	FLHX, FLHTC/U - Inner fairing - left fairing support brace FLTR - Inner fairing - left side of radio bracket
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)

DTC B2010, Passenger Audio/PTT Switch Shorted High (Part 1 of 2)





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02284_en

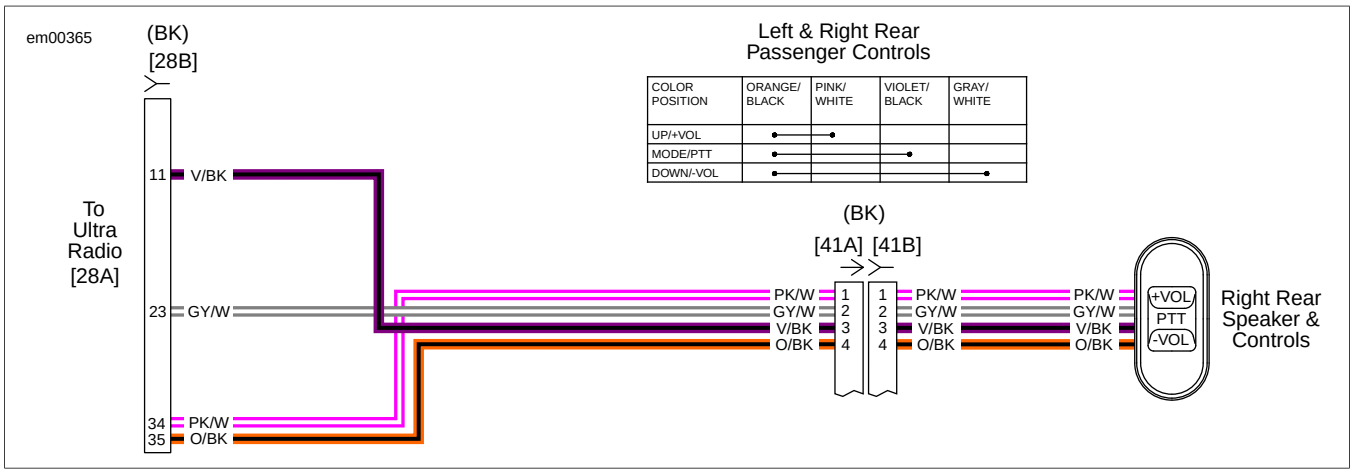


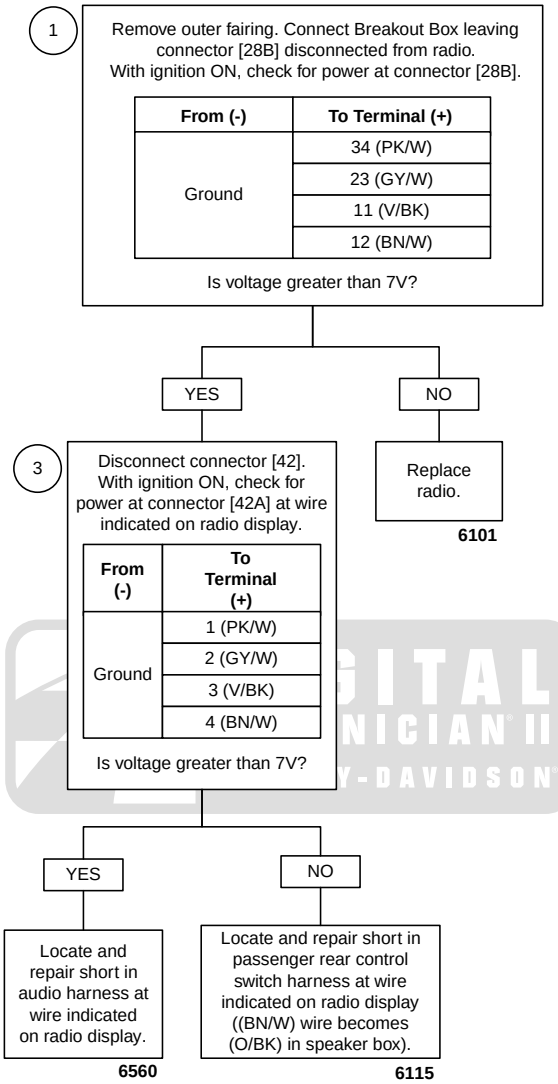
Figure 5-12. Passenger Audio/PTT Switch Circuit

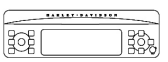
Table 5-13. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[41]	Rear right speaker/passenger controls	6-Place Mini-Deutsch	Inside rear right speaker box

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B2010, Passenger Mode Switch Shorted High (Part 2 of 2)





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02285_en

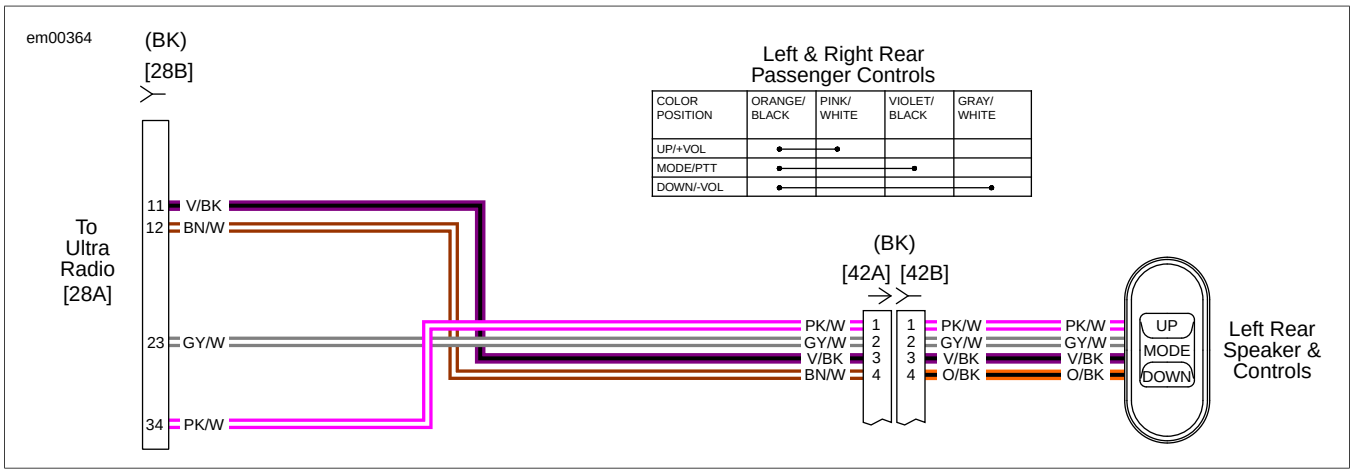


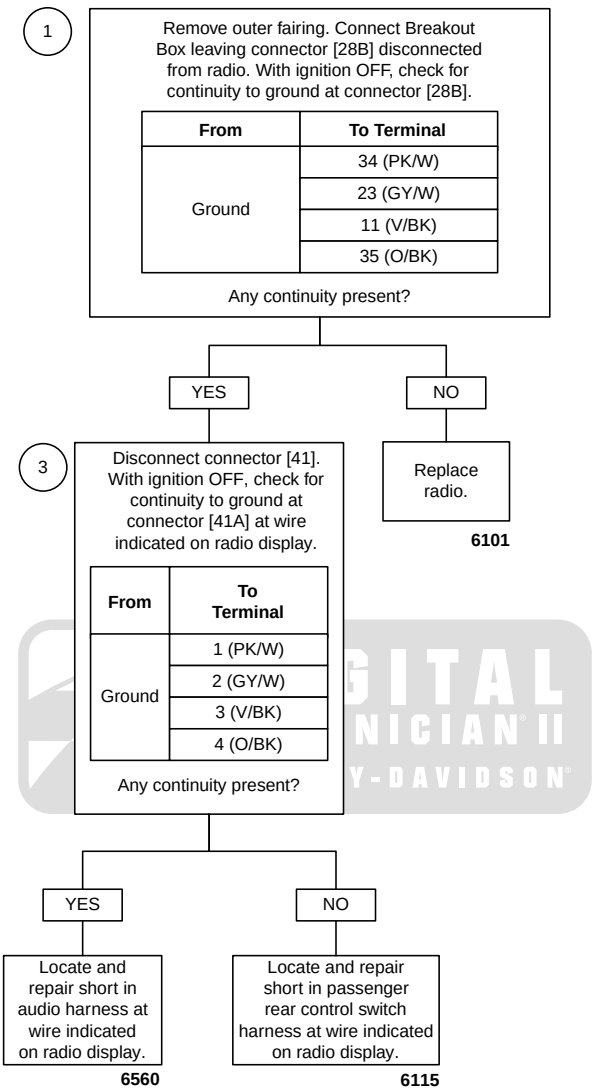
Figure 5-13. Passenger Mode Switch Circuit

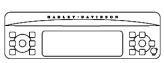
Table 5-14. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[42]	Rear left speaker/passenger controls	6-Place Mini-Deutsch	Inside rear left speaker box

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B2011, Passenger Audio/PTT Switch Shorted Low (Part 1 of 2)





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02286_en

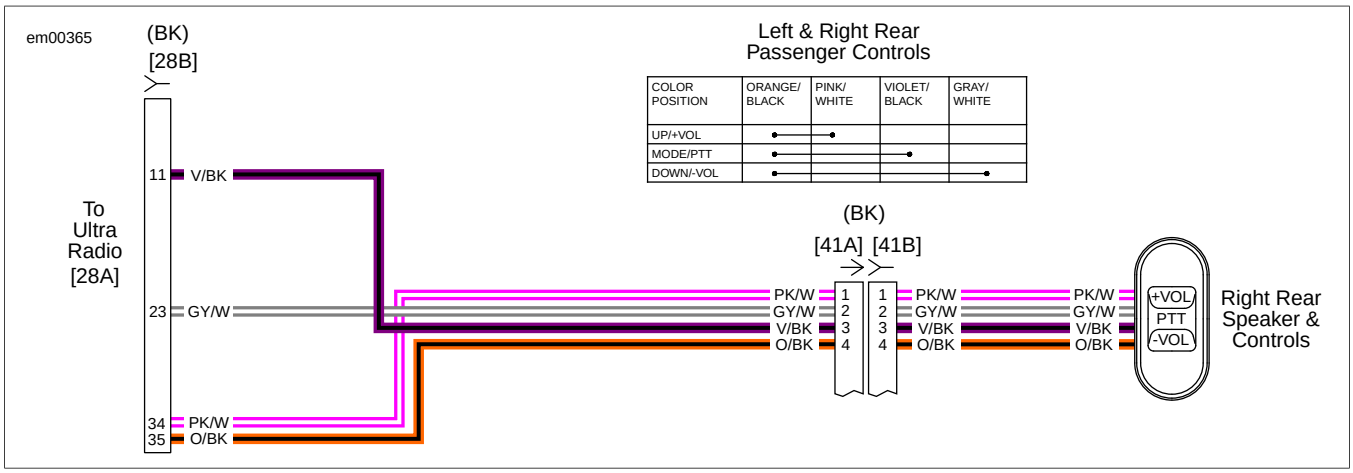


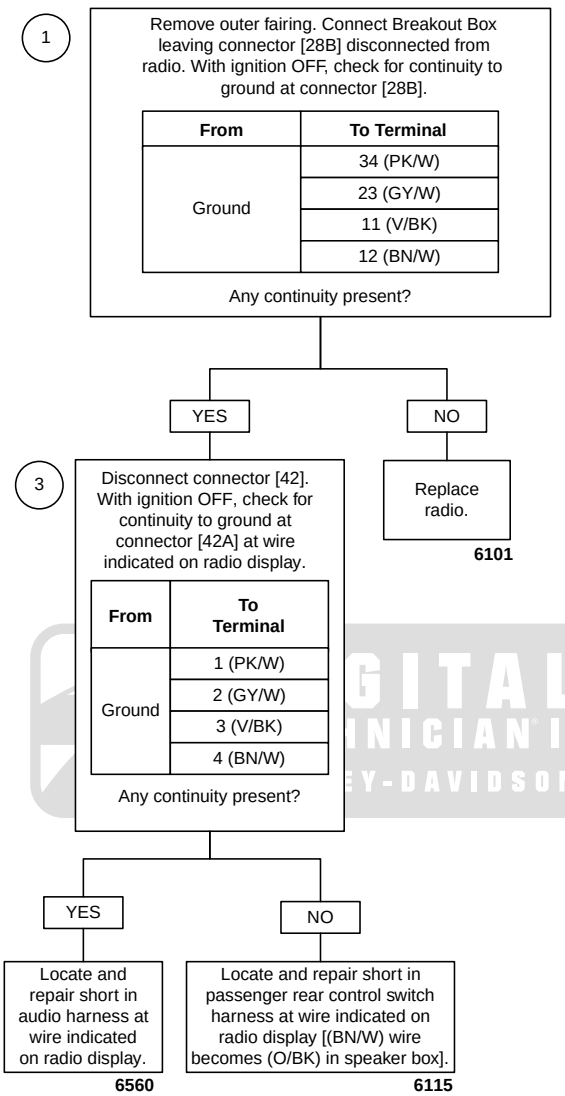
Figure 5-14. Passenger Audio/PTT Switch Circuit

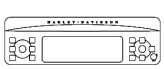
Table 5-15. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[41]	Rear right speaker/passenger controls	6-Place Mini-Deutsch	Inside rear right speaker box

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B2011, Passenger Mode Switch Shorted Low (Part 2 of 2)





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02287_en

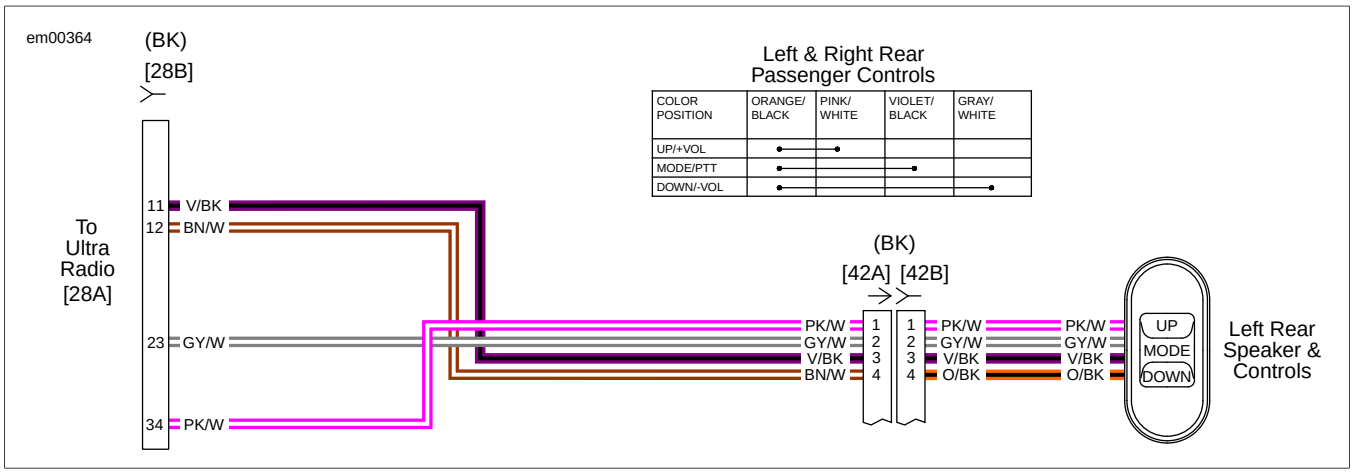


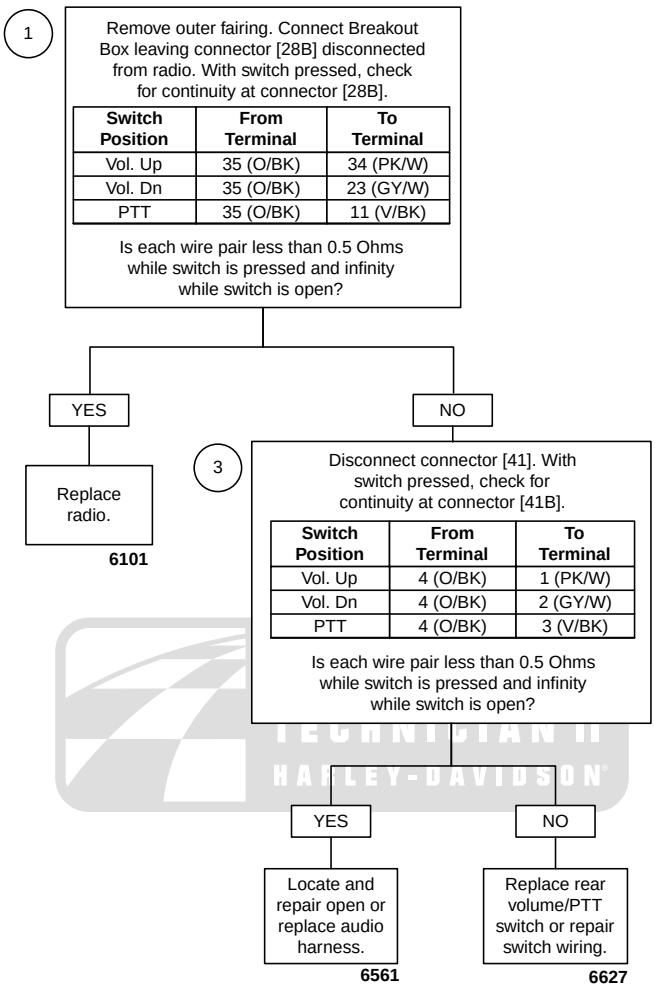
Figure 5-15. Passenger Mode Switch Circuit

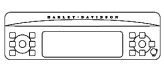
Table 5-16. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[42]	Rear left speaker/passenger controls	6-Place Mini-Deutsch	Inside rear left speaker box

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B2012, Passenger Audio/PTT Switch Stuck or Open (Part 1 of 2)





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02288_en

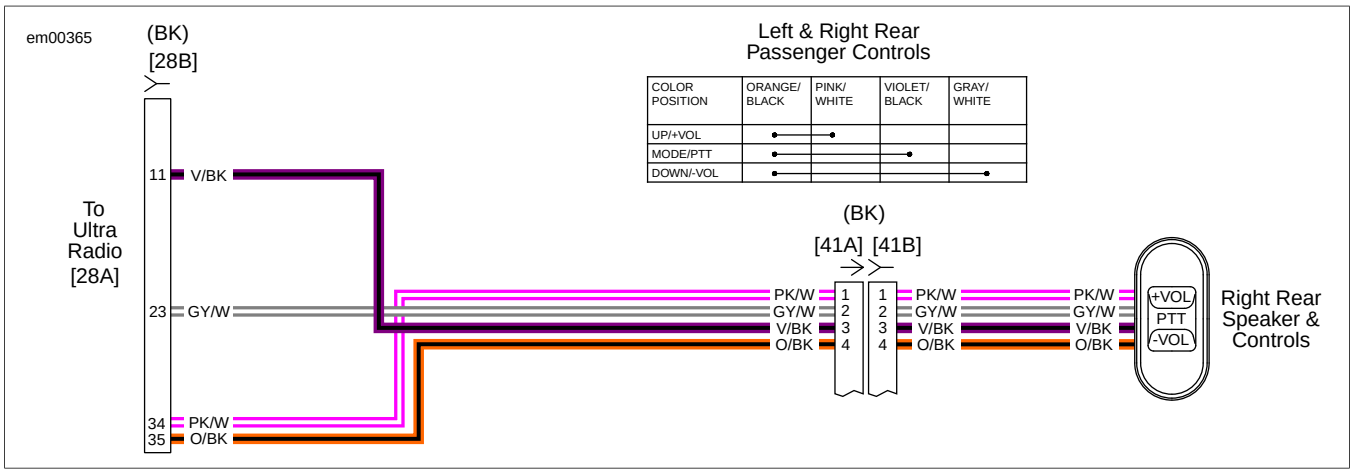


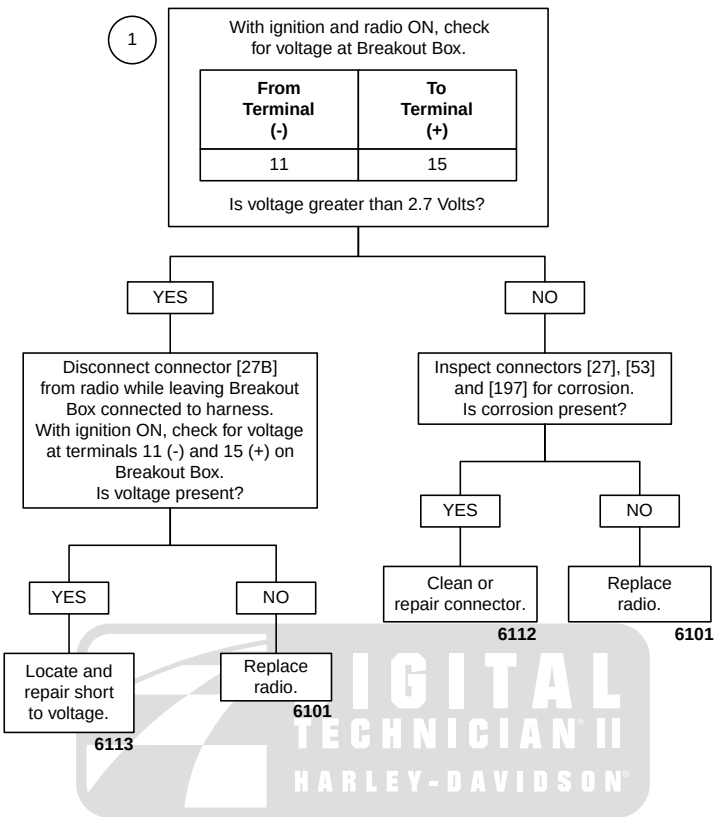
Figure 5-16. Passenger Audio/PTT Switch Circuit

Table 5-17. Wire Harness Connectors

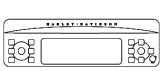
NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[41]	Rear right speaker/passenger controls	6-Place Mini-Deutsch	Inside rear right speaker box

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B2012, Passenger Mode Switch Stuck or Open (Part 2 of 2)



DIGITAL TECHNICIAN II HARLEY-DAVIDSON



Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02289_en

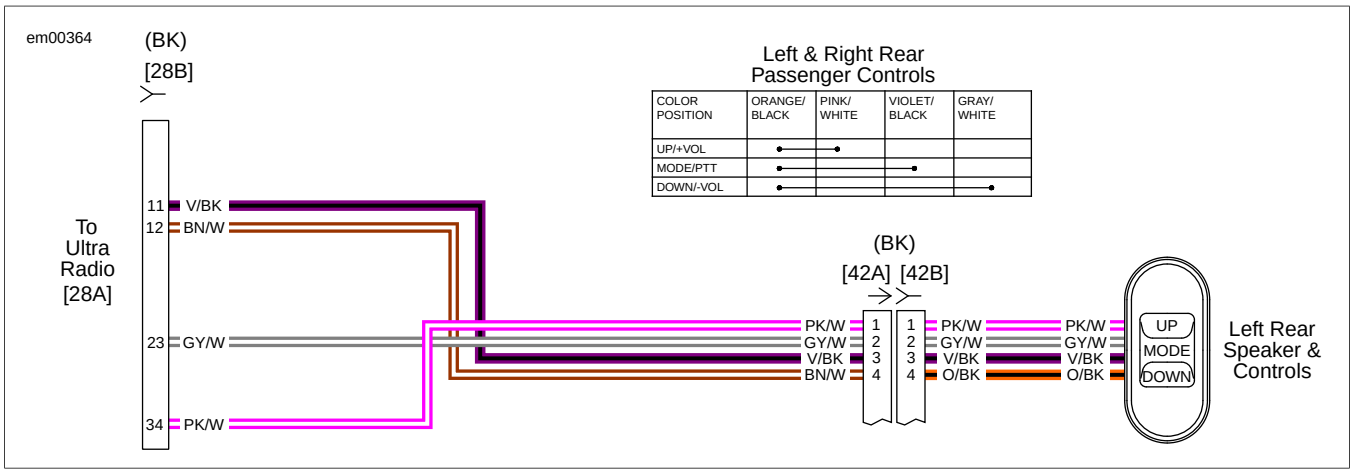


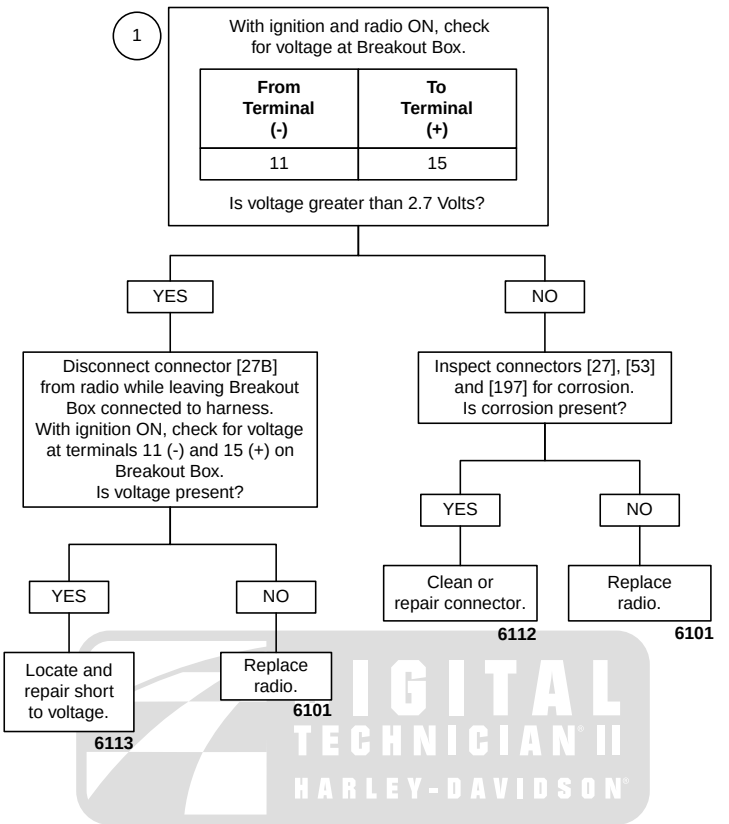
Figure 5-17. Passenger Mode Switch Circuit

Table 5-18. Wire Harness Connectors

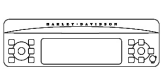
NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[42]	Rear left speaker/passenger controls	6-Place Mini-Deutsch	Inside rear left speaker box

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B2013, Sidecar Switch Shorted High



DIGITAL TECHNICIAN II HARLEY-DAVIDSON



Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02290_en

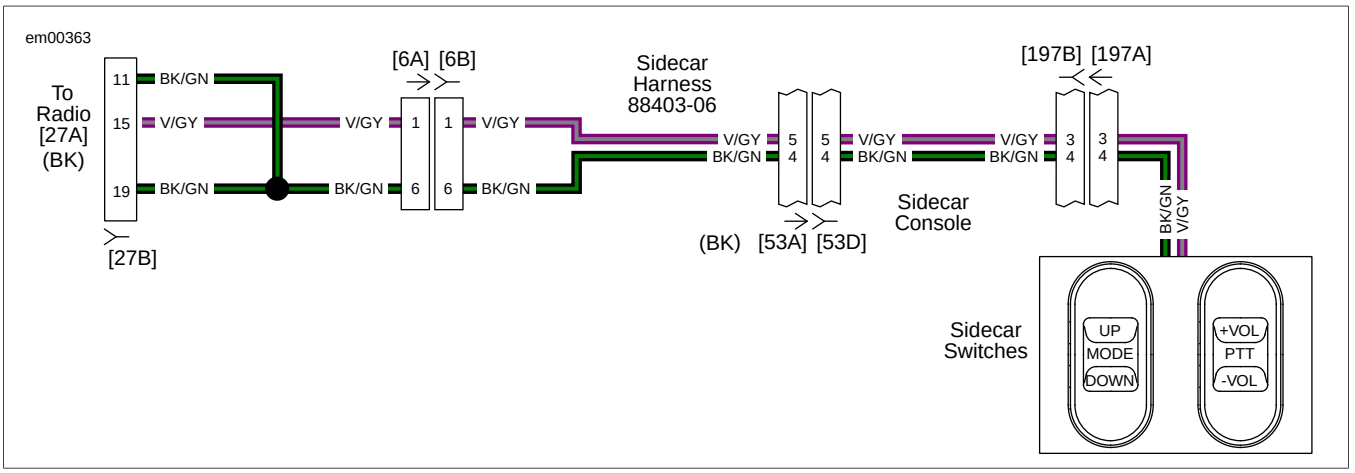


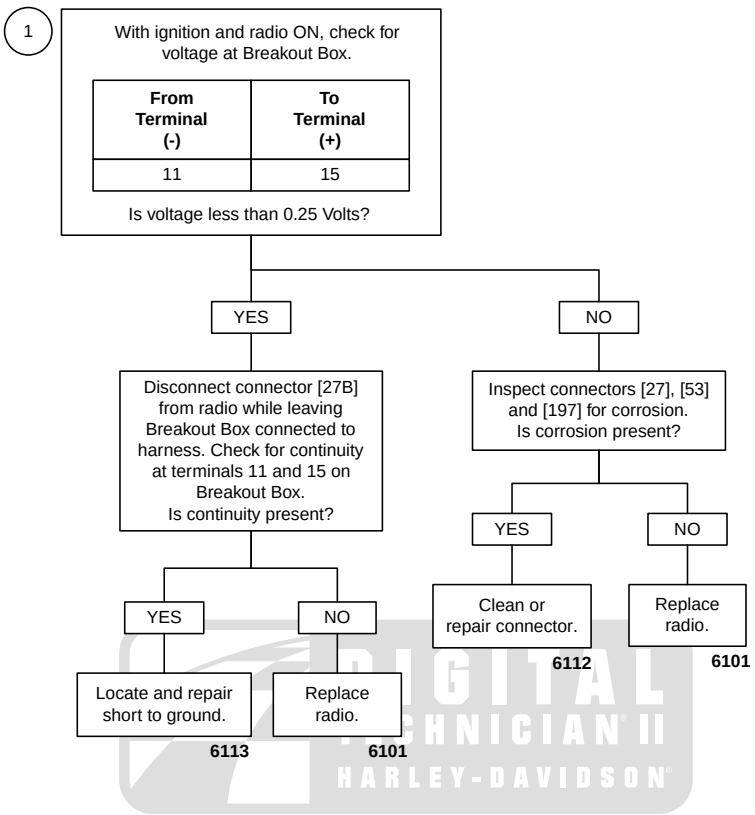
Figure 5-18. Sidecar Switch Circuit

Table 5-19. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect	6-Place Deutsch (Black)	FLHT/C/U/X - Inner fairing, left side of radio FLTR - Inner fairing - below right side of radio
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[53]	Console pod	12-Place Mini-Deutsch (Black)	Rear of battery box (under seat)
[197]	Sidecar console	12-Place Mini-Deutsch (Black)	Inside sidecar console

DIGITAL TECHNICIAN HARLEY-DAVIDSON

DTC B2014, Sidecar Switch Shorted Low



Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02291_en

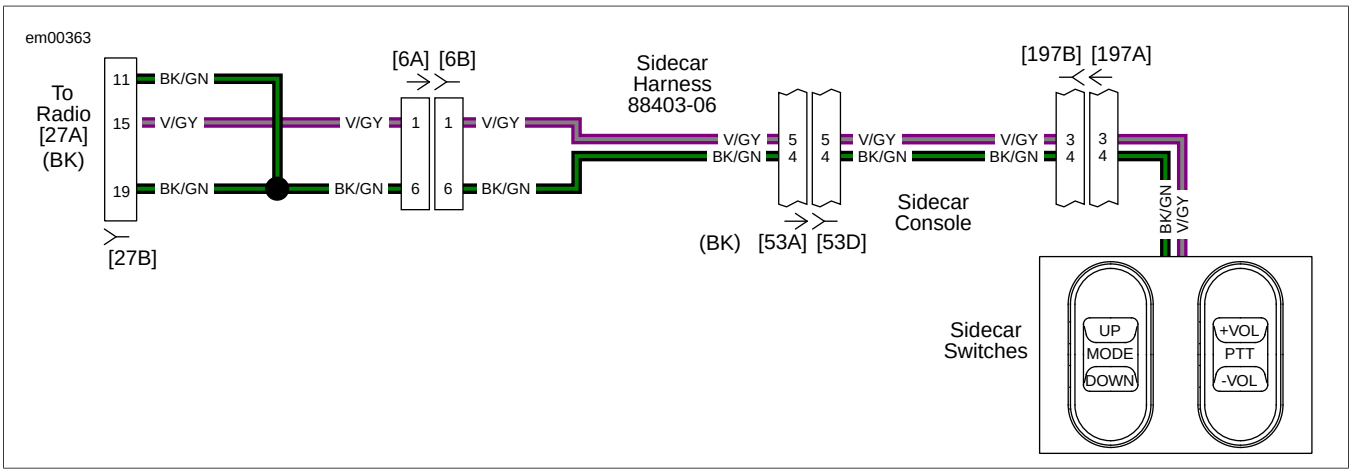


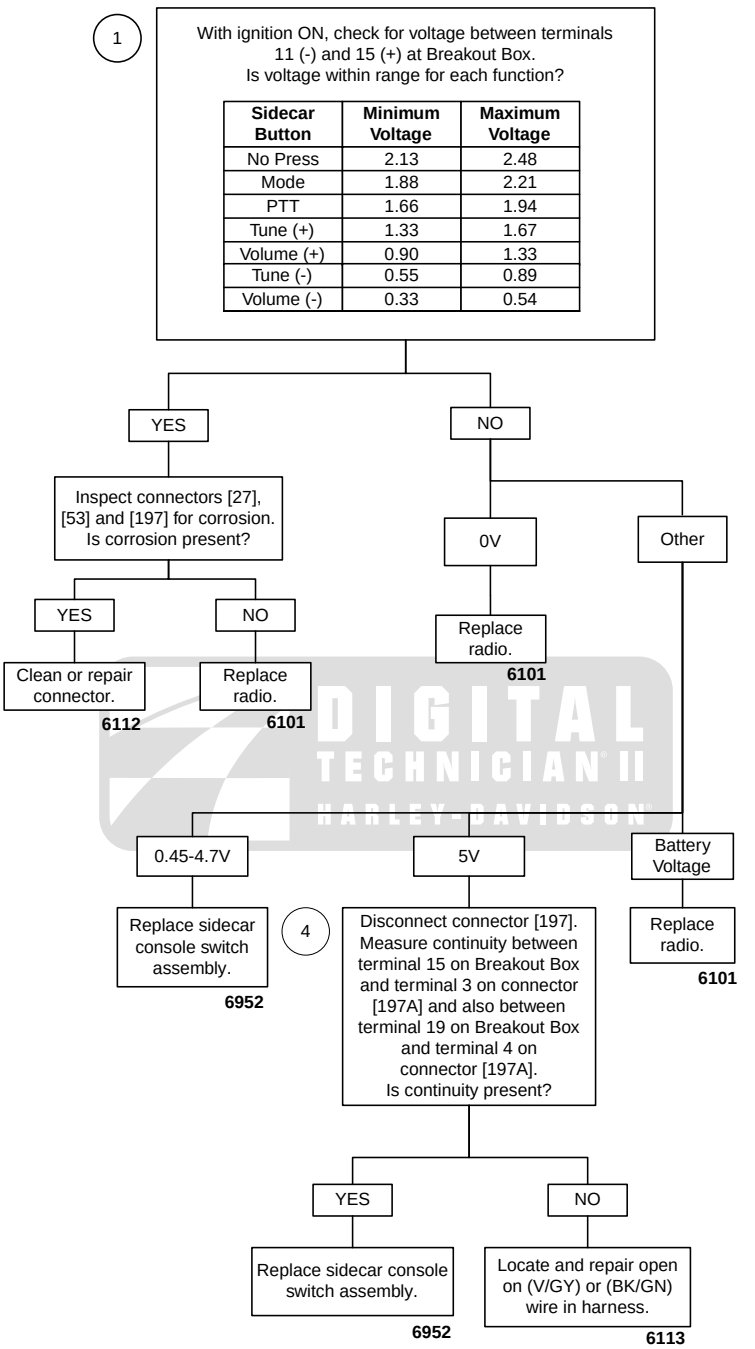
Figure 5-19. Sidecar Switch Circuit

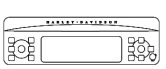
Table 5-20. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect	6-Place Deutsch (Black)	FLHT/C/U/X - Inner fairing, left side of radio FLTR - Inner fairing - below right side of radio
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[53]	Console pod	12-Place Mini-Deutsch (Black)	Rear of battery box (under seat)
[197]	Sidecar console	12-Place Mini-Deutsch (Black)	Inside sidecar console

DIGITAL TECHNICIAN HARLEY-DAVIDSON

DTC B2015, Sidecar Switches Stuck or Open





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02292_en

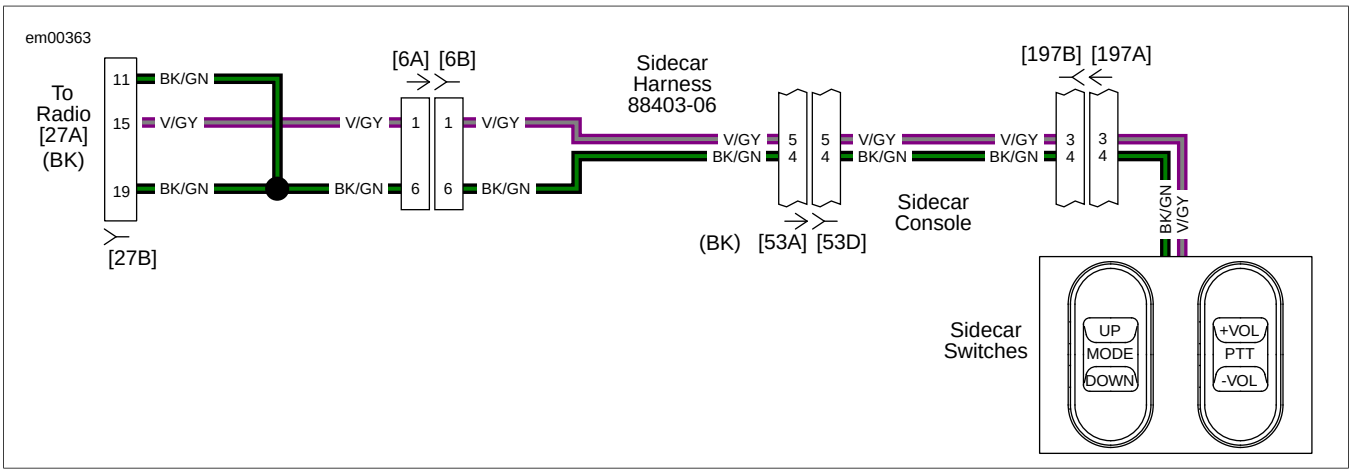


Figure 5-20. Sidecar Switch Circuit

Table 5-21. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect	6-Place Deutsch (Black)	FLHT/C/U/X - Inner fairing, left side of radio FLTR - Inner fairing - below right side of radio
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[53]	Console pod	12-Place Mini-Deutsch (Black)	Rear of battery box (under seat)
[197]	Sidecar console	12-Place Mini-Deutsch (Black)	Inside sidecar console

DIGITAL TECHNICIAN HARLEY-DAVIDSON

DTC B2016-B2027, RADIO SPEAKER DIAGNOSTICS 5.3

GENERAL

The sound system is designed to capture faults for each of the radio speaker outputs. When a fault is detected, a DTC is generated. Refer to Table 5-22. The DTC and related data appears on the radio display when the system is in the diagnostic mode.

Table 5-22. Code Description

DTC	DESCRIPTION
B2016	Front speakers shorted
B2017	Front speakers open
B2018	Front speakers shorted to ground
B2019	Front speakers shorted to battery
B2020	Rear speakers shorted
B2021	Rear speakers open
B2022	Rear speakers shorted to ground
B2023	Rear speakers shorted to battery
B2024	Sidecar speakers shorted
B2025	Sidecar speakers open
B2026	Sidecar speakers shorted to ground
B2027	Sidecar speakers shorted to battery

DIAGNOSTICS

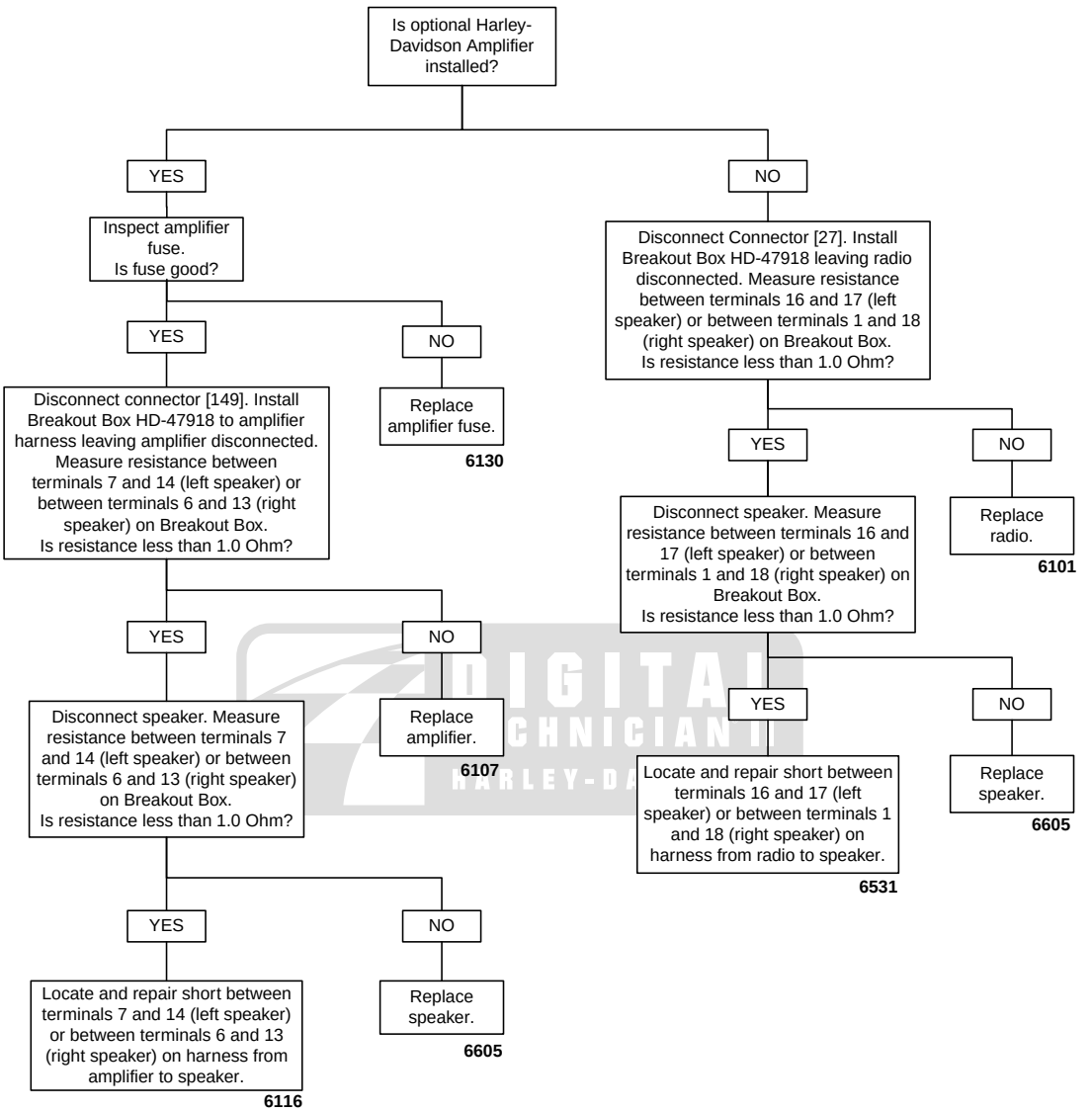
PART NUMBER	TOOL NAME
HD-47918	RADIO BREAKOUT BOX

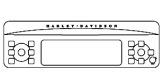
Diagnostic Notes

Unless specified otherwise, install RADIO BREAKOUT BOX (Part No. HD-47918) when called for in the following flowcharts.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B2016, Front Speakers Shorted





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02293_en

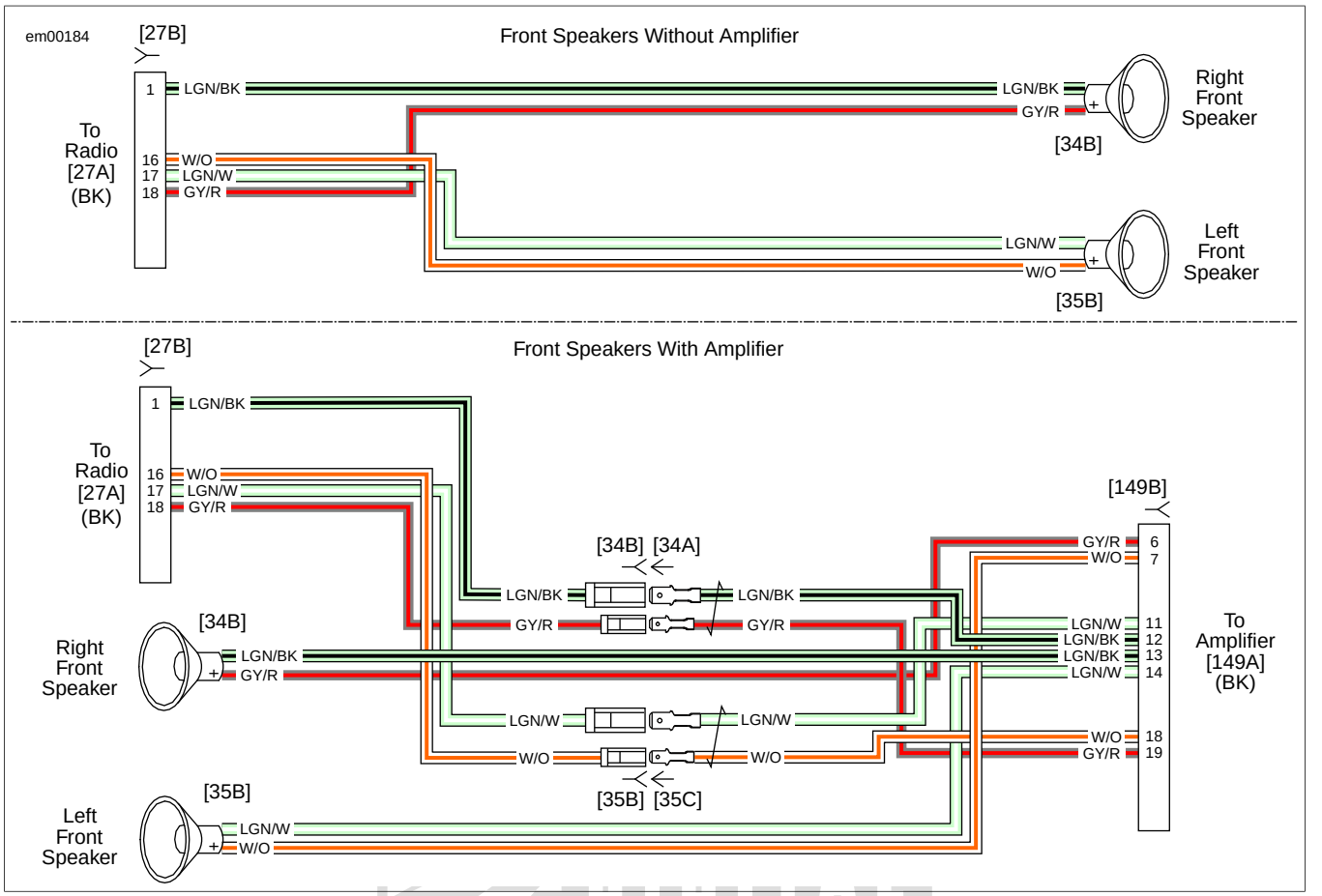
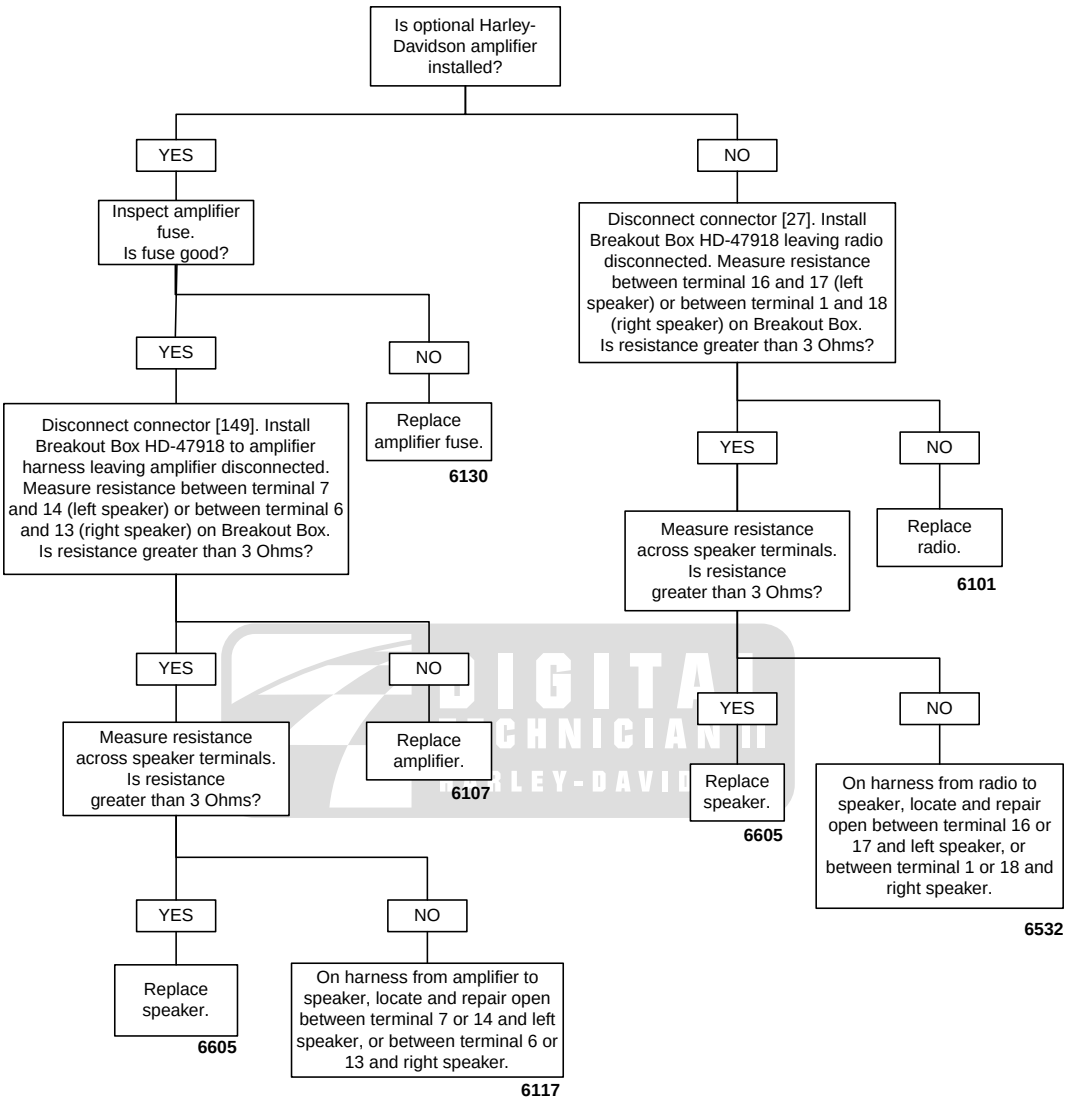


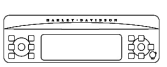
Figure 5-21. Front Speaker Circuit

Table 5-23. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[34]	Front right speaker	Spade Contacts	Inner fairing - back of right speaker
[35]	Front left speaker	Spade Contacts	Inner fairing - back of left speaker
[149]	High output amplifier	23-Place Amp	Under luggage rack (right side)

DTC B2017, Front Speakers Open

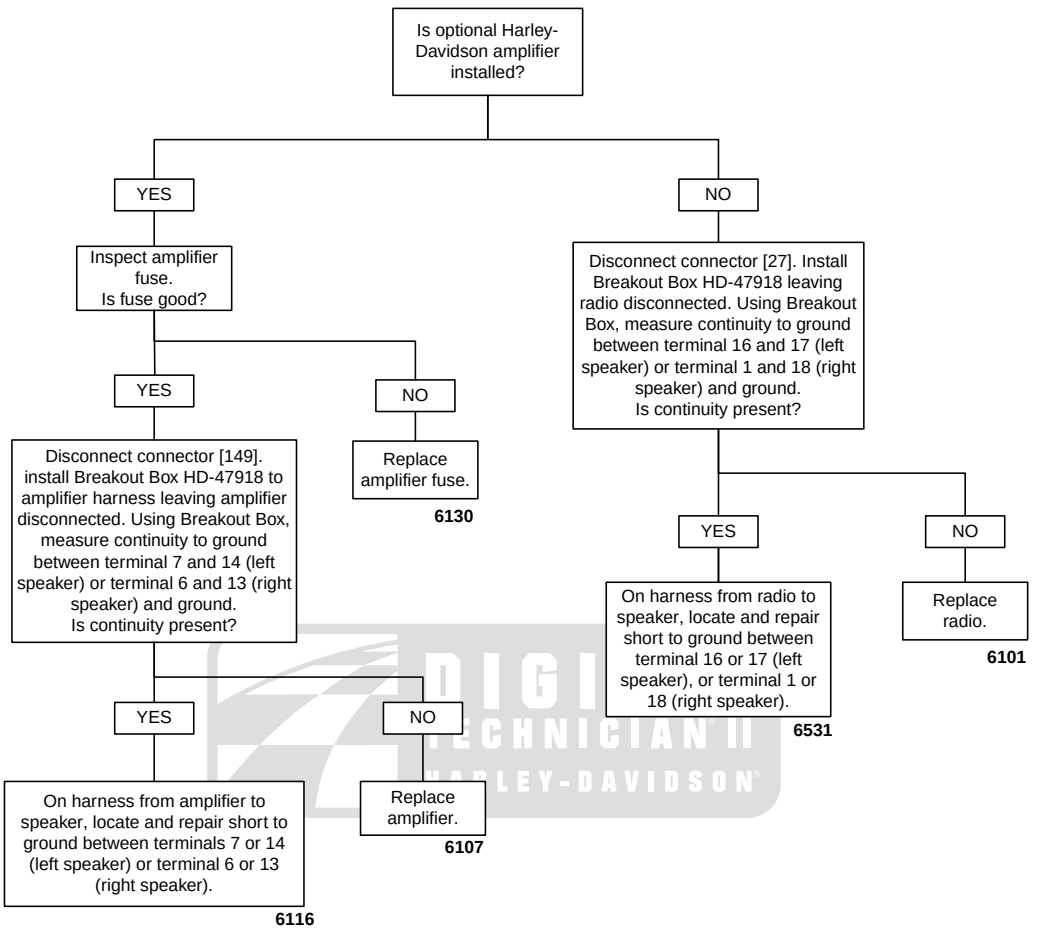


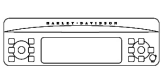


Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02294_en

DTC B2018, Front Speakers Shorted to Ground

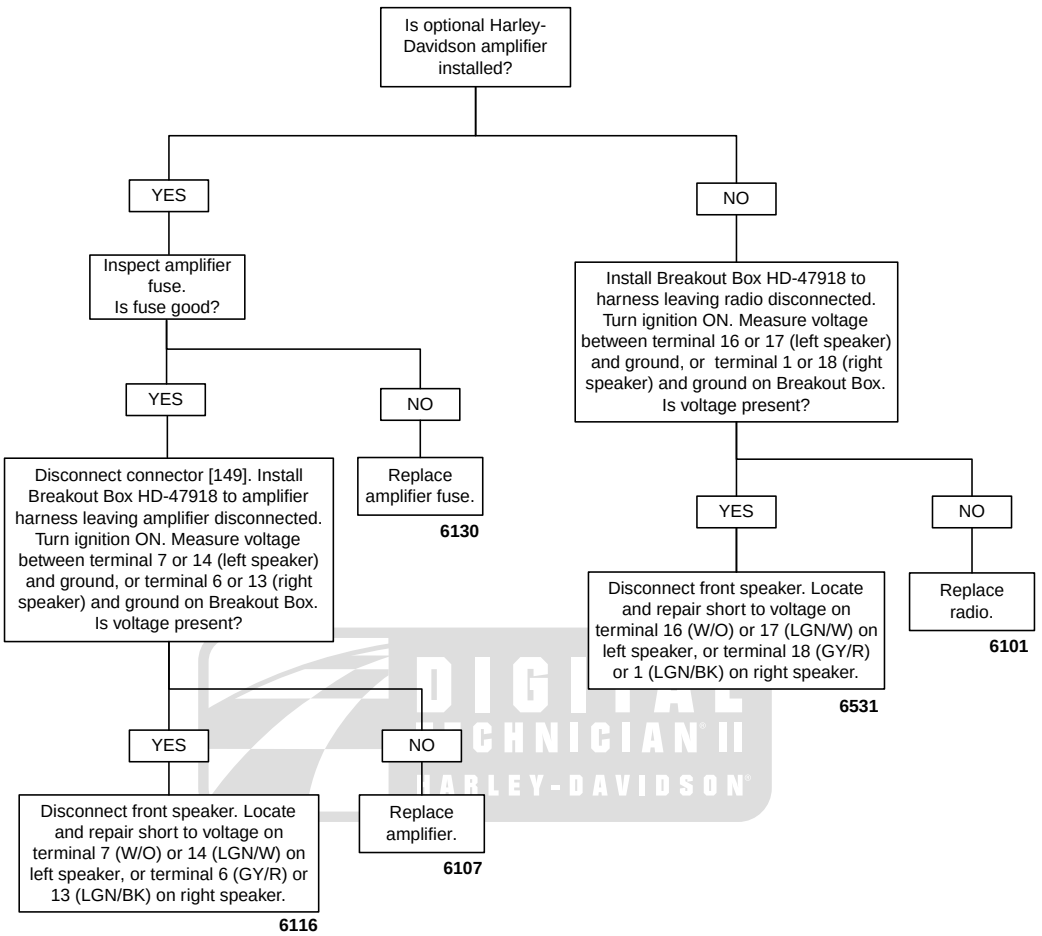


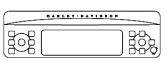


Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02295_en

DTC B2019, Front Speakers Shorted to Battery

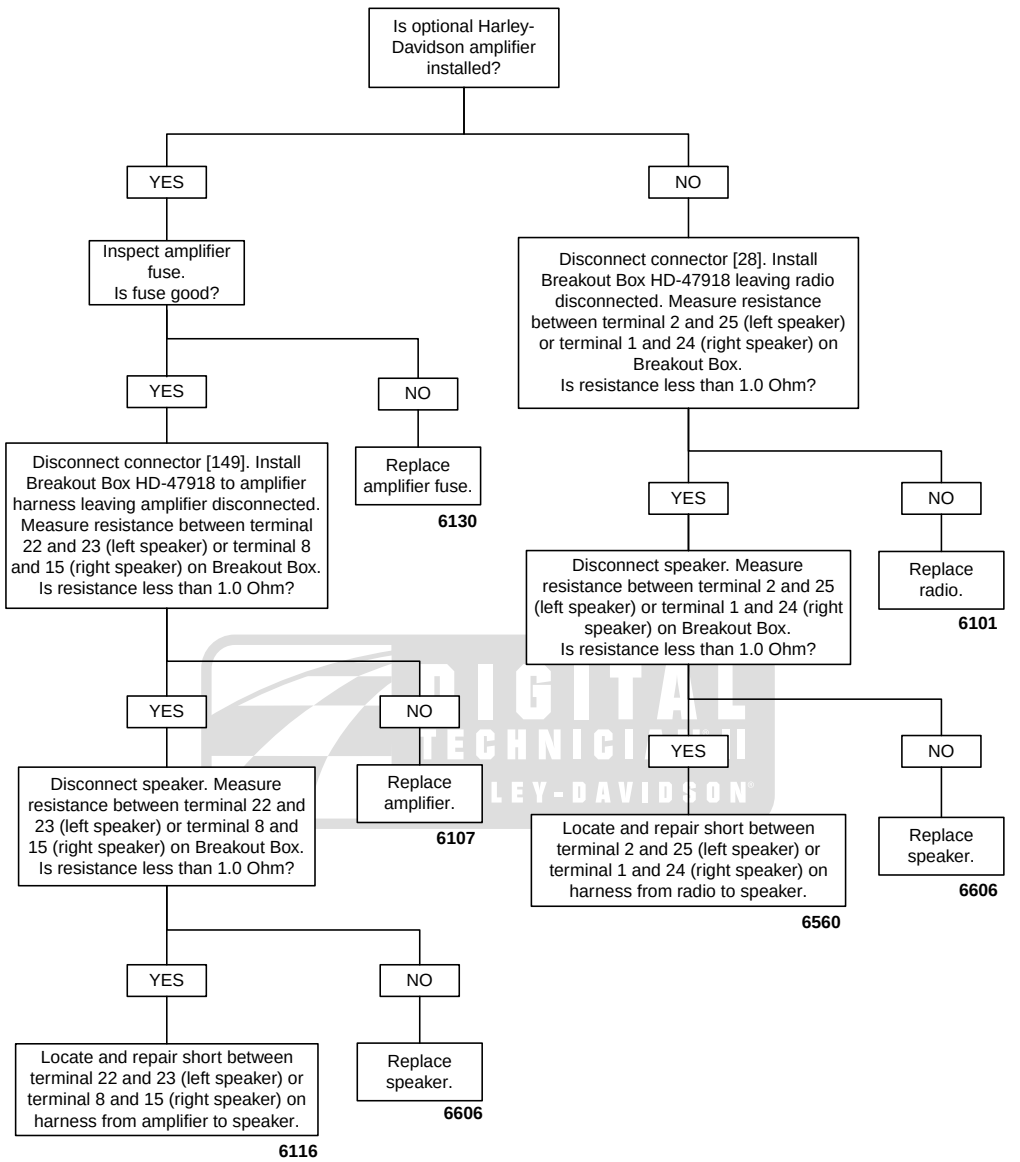


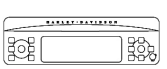


Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02296_en

DTC B2020, Rear Speakers Shorted





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02297_en

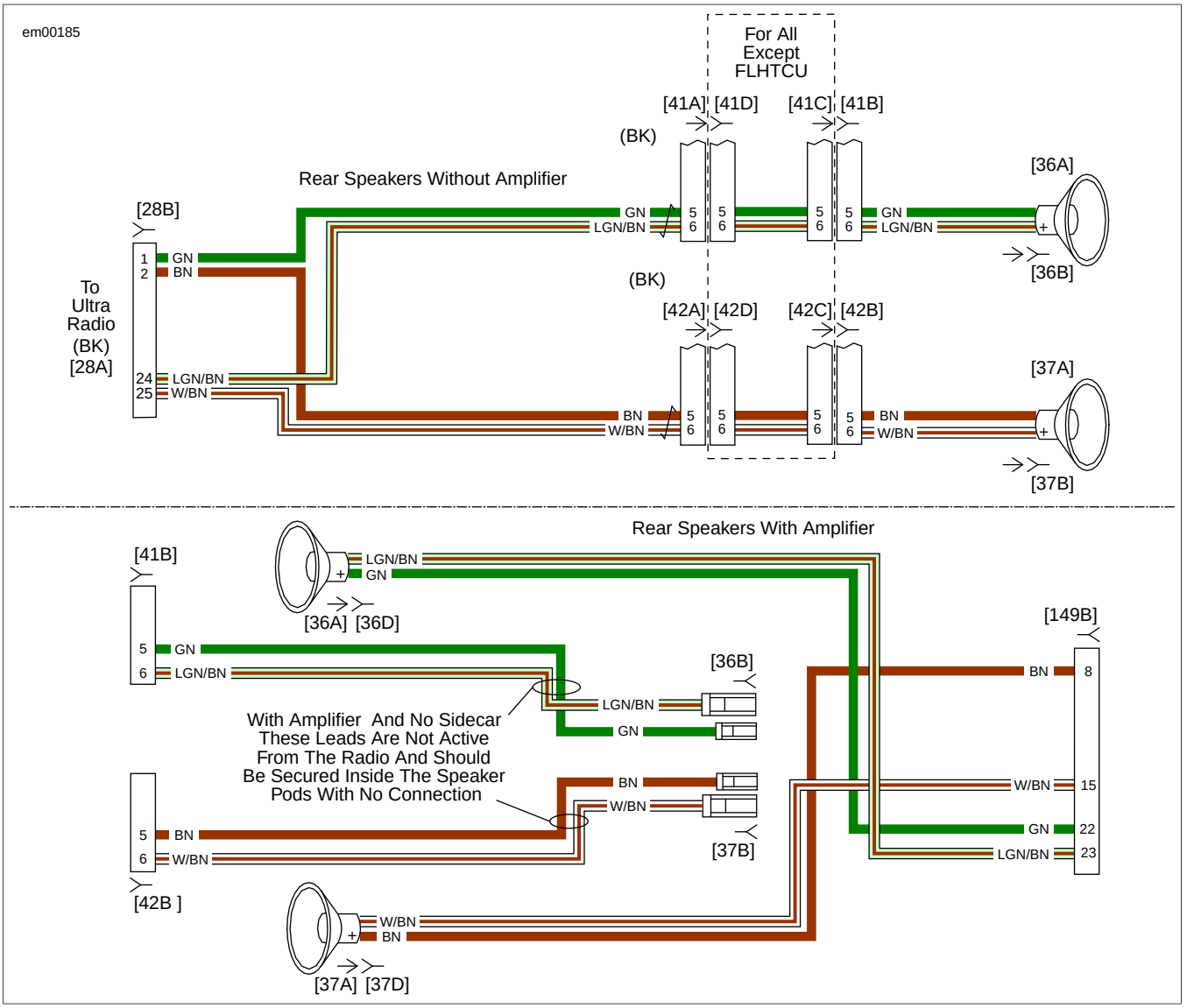
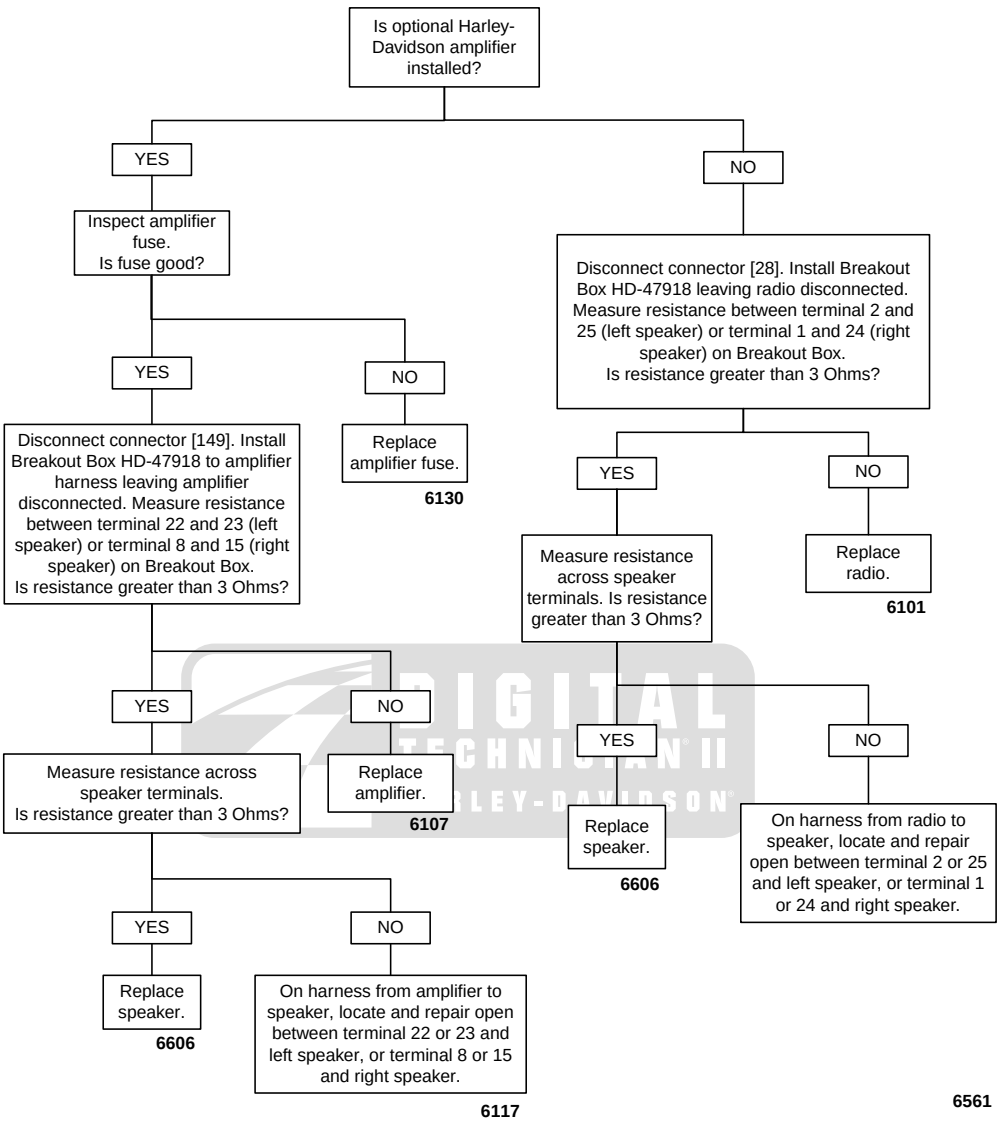


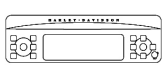
Figure 5-22. Rear Speaker Circuit

Table 5-24. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[36]	Rear right speaker	Spade Contacts	Inside rear right speaker box
[37]	Rear left speaker	Spade Contacts	Inside rear left speaker box
[41]	Rear right speaker/passenger controls	6-Place Mini-Deutsch	Inside rear right speaker box
[42]	Rear left speaker/passenger controls	6-Place Mini-Deutsch	Inside rear left speaker box
[149]	High output amplifier	23-Place Amp	Under luggage rack (right side)

DTC B2021, Rear Speakers Open

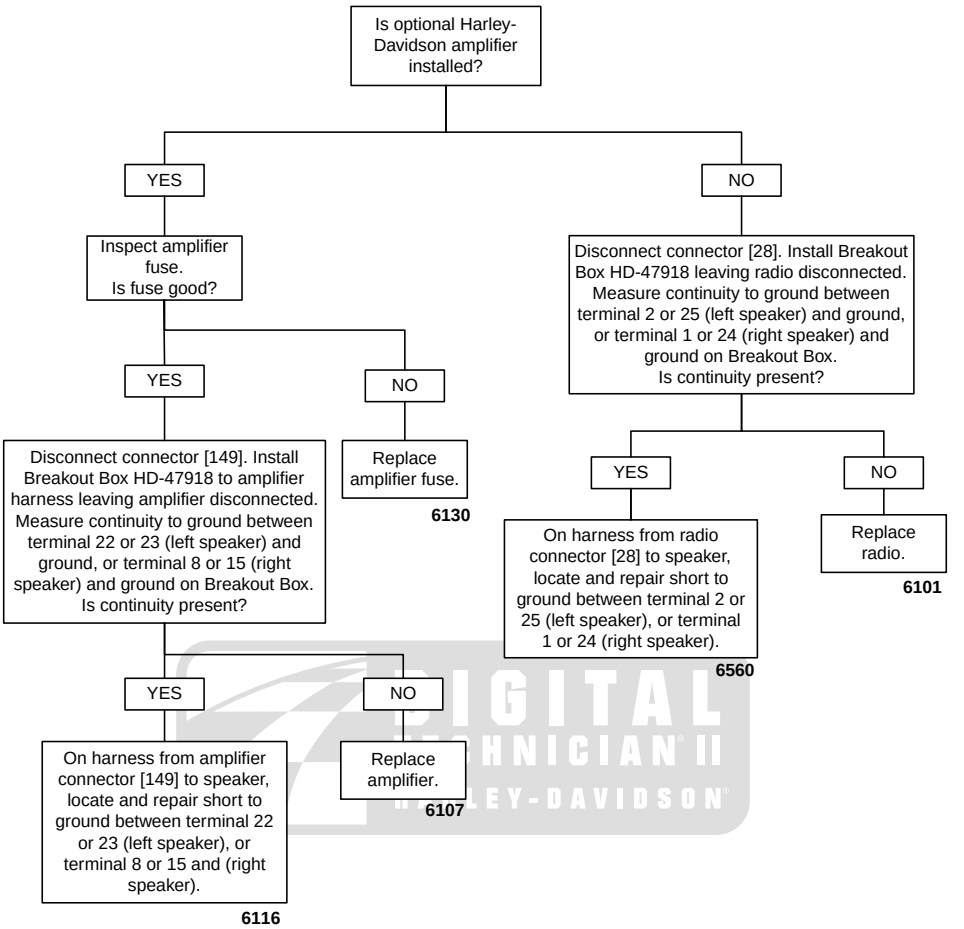




Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02298_en

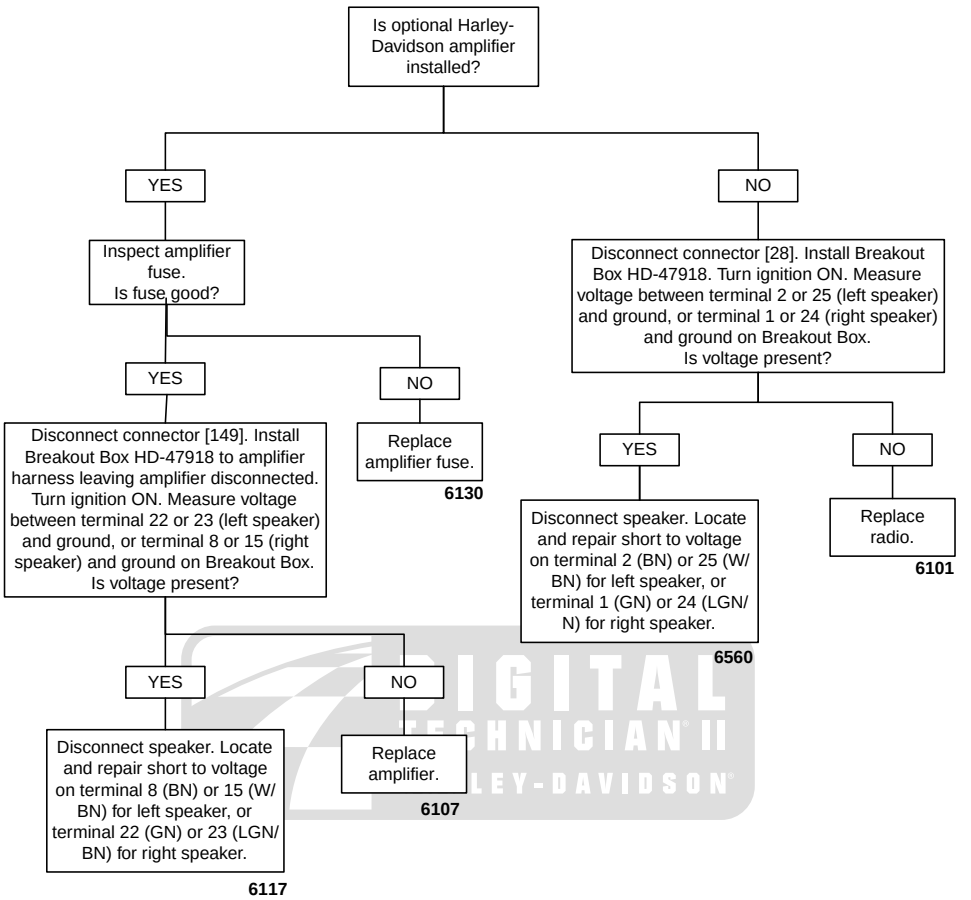
DTC B2022, Rear Speakers Shorted to Ground

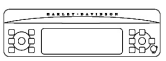


Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02299_en

DTC B2023, Rear Speakers Shorted to Battery

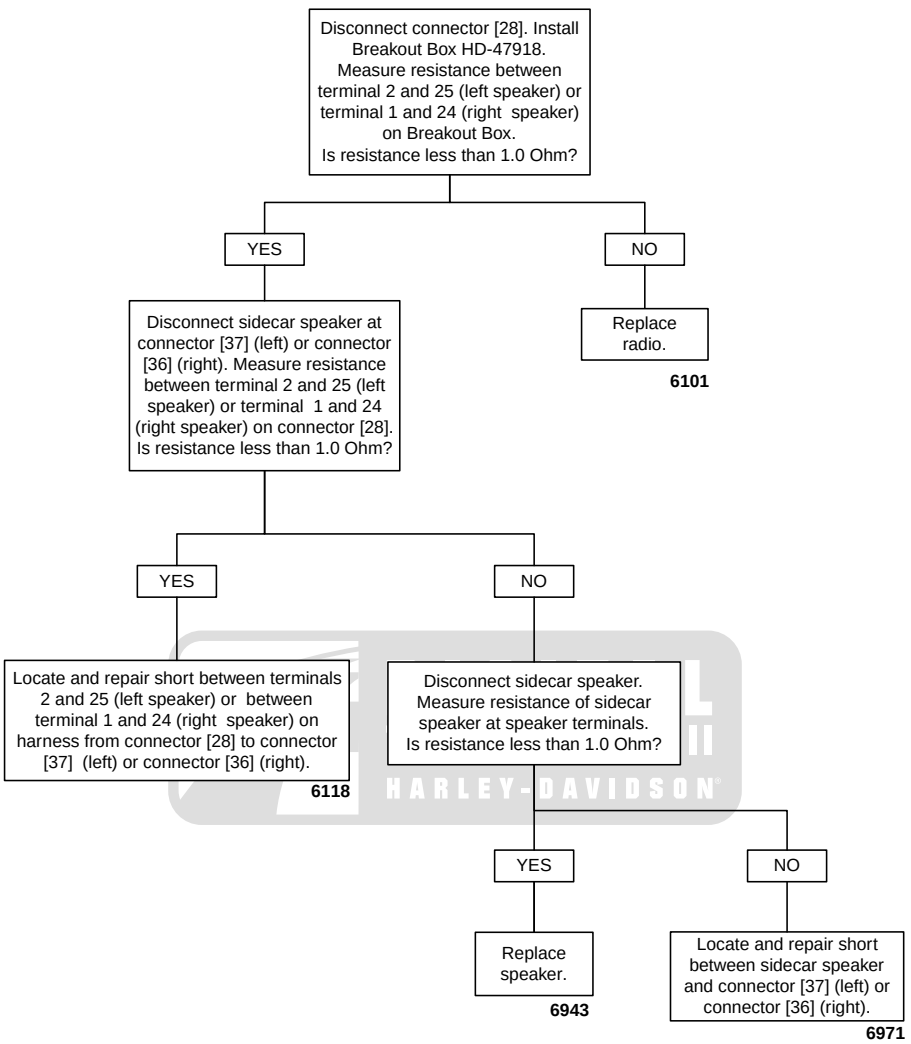


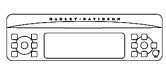


Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02300_en

DTC B2024, Sidecar Speakers Shorted





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02301_en

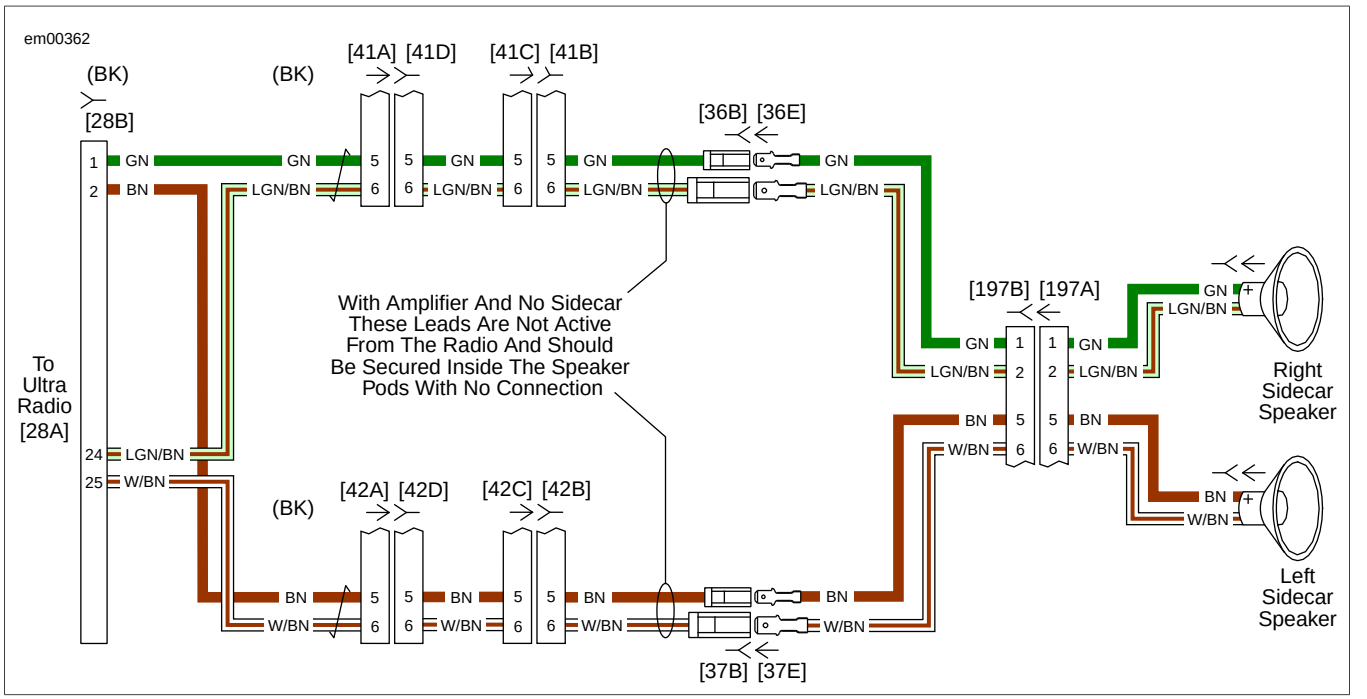
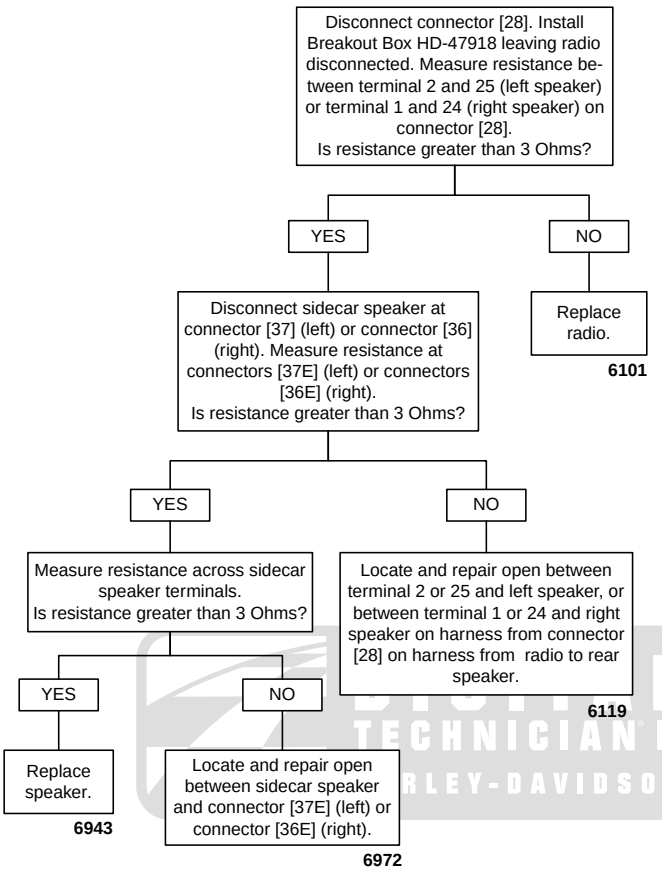


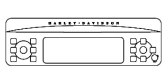
Figure 5-23. Sidecar Speaker Circuit

Table 5-25. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[36]	Rear right speaker	Spade Contacts	Inside rear right speaker box
[37]	Rear left speaker	Spade Contacts	Inside rear left speaker box
[41]	Rear right speaker/passenger controls	6-Place Mini-Deutsch	Inside rear right speaker box
[42]	Rear left speaker/passenger controls	6-Place Mini-Deutsch	Inside rear left speaker box
[197]	Sidecar console	12-Place Mini-Deutsch	Inside sidecar console

DTC B2025, Sidecar Speakers Open

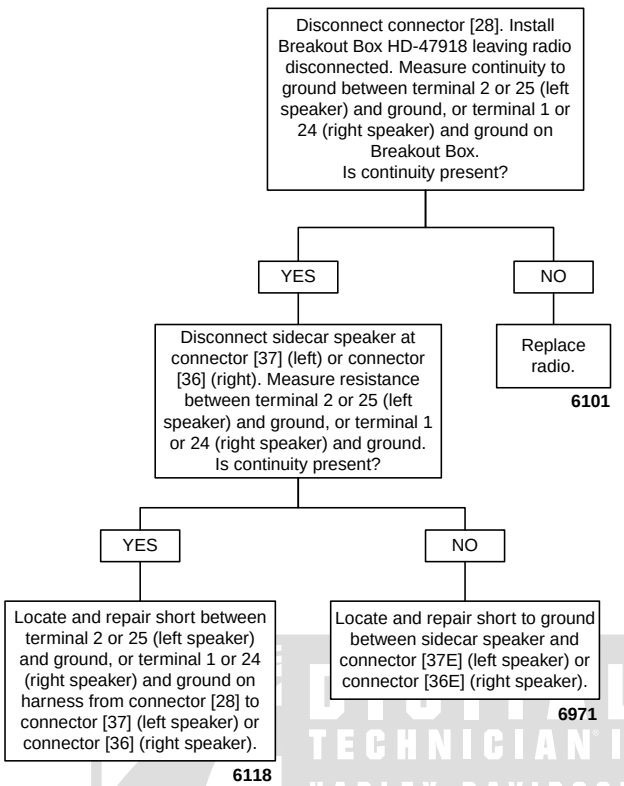


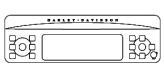


Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02302_en

DTC B2026, Sidecar Speakers Shorted to Ground

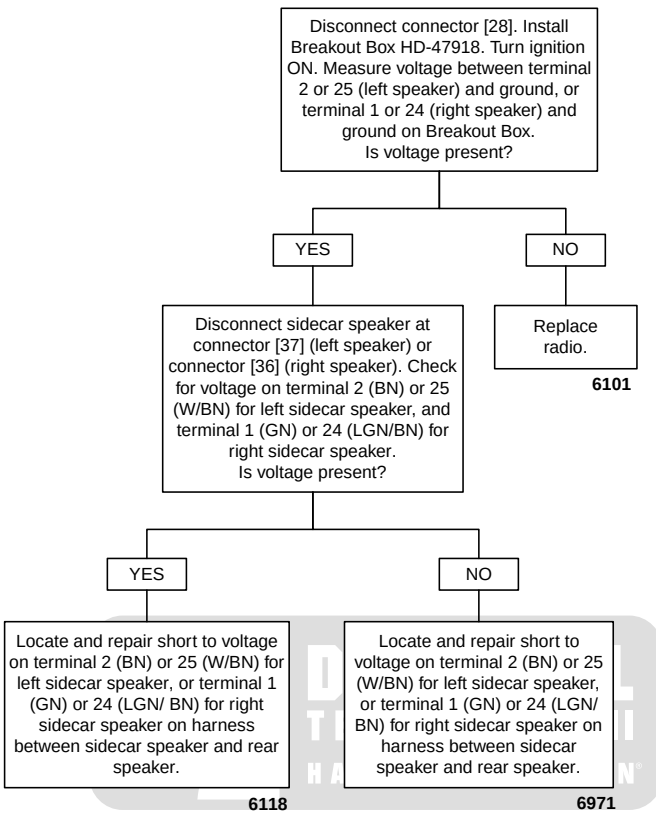


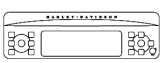


Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02303_en

DTC B2027, Sidecar Speakers Shorted to Battery





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02304_en

SERIAL DATA BUS DIAGNOSTICS 5.4

GENERAL

There are two serial data BUSs. The first one is the J1850 serial data BUS which communicates between the radio and the ECM, TSSM and instruments. Refer to Table 5-26. The second serial data BUS is the Infotainment BUS, which uses a CAN protocol to communicate between the radio and the other radio accessories. Refer to Table 5-27. The radio captures any errors found on both serial data BUSs and stores them as DTCs.

Table 5-26. J1850 Serial Data Bus

DTC	DESCRIPTION
U1016	J1850 lost communications with ECM
U1300	J1850 bus shorted low
U1301	J1850 bus shorted high

Table 5-27. Infotainment BUS

DTC	DESCRIPTION
U1302	Infotainment bus off error
U1306	Infotainment bus lost communications with hands-free phone module
U1307	Infotainment bus lost communications with CB
U1308	Infotainment bus lost communications with future
U1312	Infotainment bus lost communications with future
U1313	Infotainment bus lost communications with XM
U1314	Infotainment bus lost communications with navigation
U1317	Infotainment bus lost communications with high output amplifier

Loss of Serial Data: DTC U1016

The serial data connector provides a means for the ECM, TSM/TSSM and speedometer to communicate their current status. When all operating parameters on the serial data bus are within specifications, a state of health message is sent between the components. DTC U1016 indicates that the ECM is incapable of sending this state of health message.

Starts then Stalls: DTC U1300, U1301

The typical serial data voltage range is 0 (inactive) to 7 Volts (active). Due to the short pulse, voltages will be much lower on a DVOM. In analog mode, a DVOM reading serial data will show continuous voltage when active, typically 0.6-0.8 Volts. The range for acceptable operations is greater than 0 and less than 7.0 Volts.

NOTE

Problems in the fuel system or idle air control system may also create this symptom.

Diagnostic Tips

- If serial data is shorted, these codes will automatically trip the check engine light.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.
- If radio ground and antenna ground are open, a serial data BUS fault may occur causing a start and stall condition.

DIAGNOSTICS

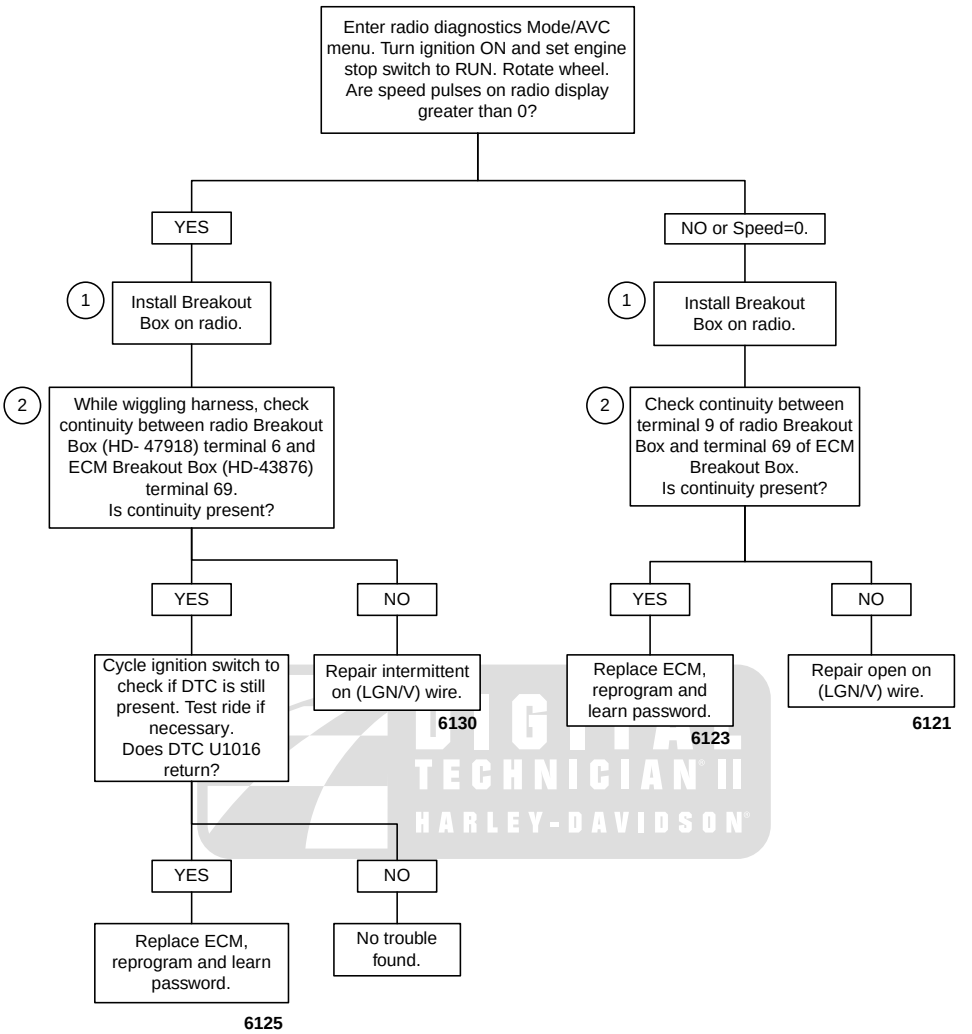
PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX
HD-47918	RADIO BREAKOUT BOX

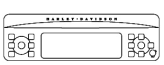
Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Install RADIO BREAKOUT BOX (Part No. HD-47918).
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), black socket probes and patch cord.
4. This 18-place connector is located on the hands-free phone module. Disconnect the connector and GENTLY touch the probes to the terminals to make the measurement. Do not insert probe into connector.
5. The amplifier fuse is an inline fuse for all accessory installations and is mounted in the fuse block.

DTC U1016, J1850 Lost Communications with ECM





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02305_en

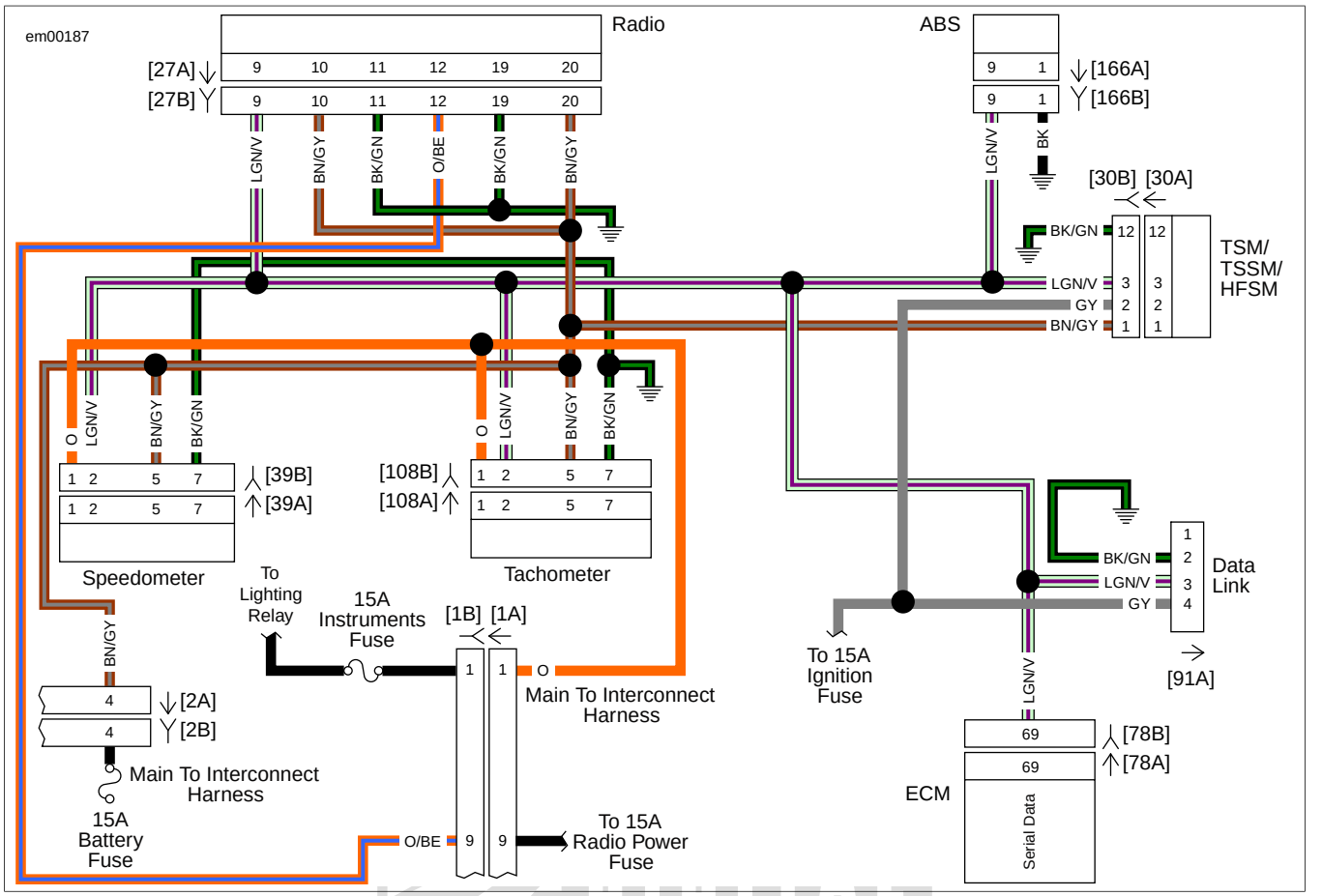
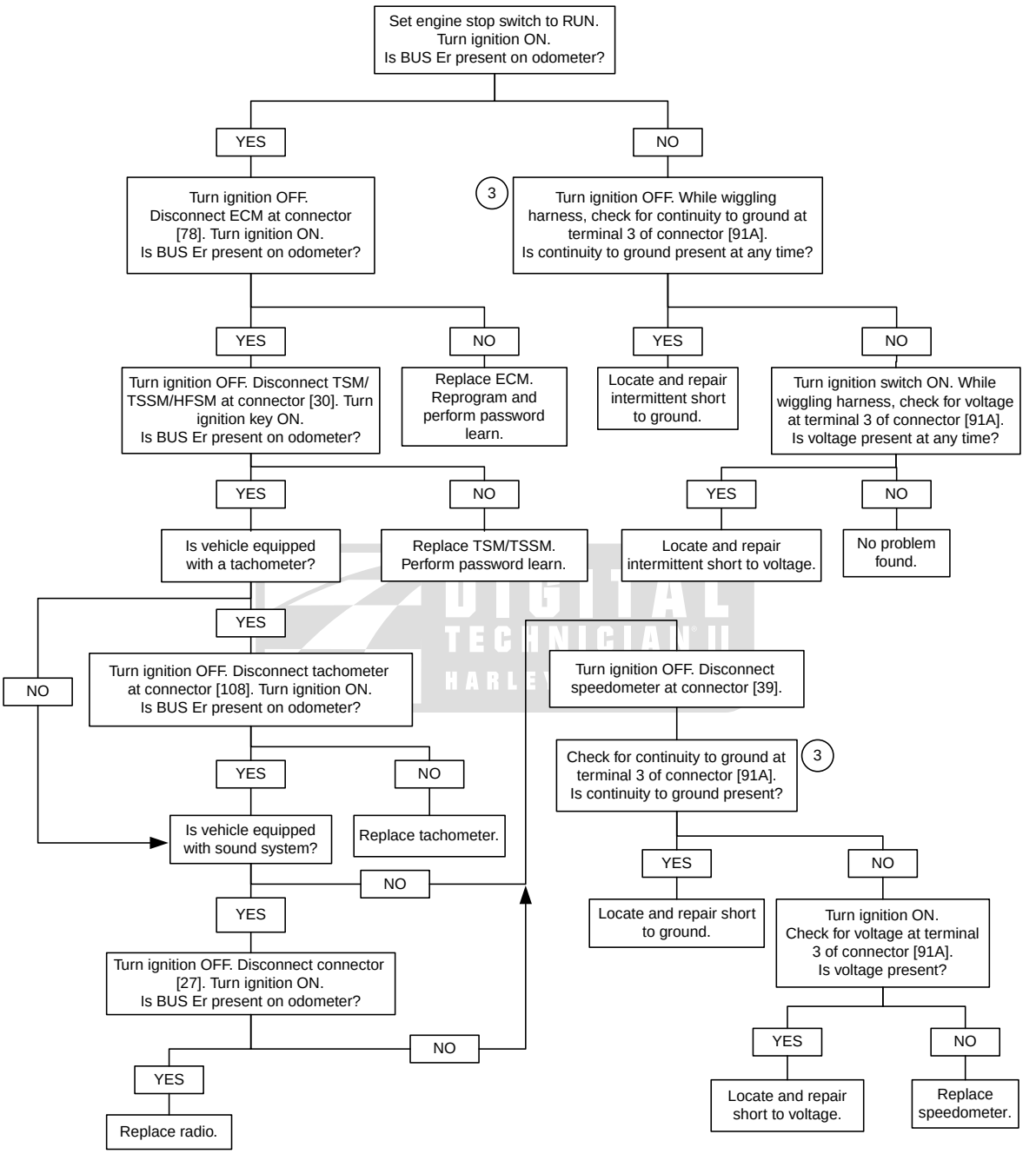


Figure 5-24. Serial Data Circuit: FLHX, FLHT/C/U, FLTR

Table 5-28. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-Place Molex (Black)	FLHT/C - Inner fairing - right radio support bracket FLTR - Inner fairing - below radio (right side)
[2]	Main to interconnect harness	12-Place Molex (Gray)	FLHT/C - Inner fairing - right fairing support brace FLTR - Inner fairing - below radio (right side)
[27]	Radio	23-Place Amp	FLHTC/U/X - Inner fairing - back of radio (right side)
[30]	TSM/TSSM/HFSM	12-Place Deutsch	Under right side cover
[39]	Speedometer	12-Place Packard	FLHT/C - Inner fairing (back of speedometer) FLTR - Under bezel (back of speedometer)
[78]	ECM	73-Place Packard	Under seat
[91]	DLC	4-Place Deutsch	Under left side cover
[108]	Tachometer	12-Place Packard	FLHT/C - Inner fairing (back of tachometer) FLTR - Under bezel (back of tachometer)
[166]	ABS module	20-Place Molex	Under right side cover

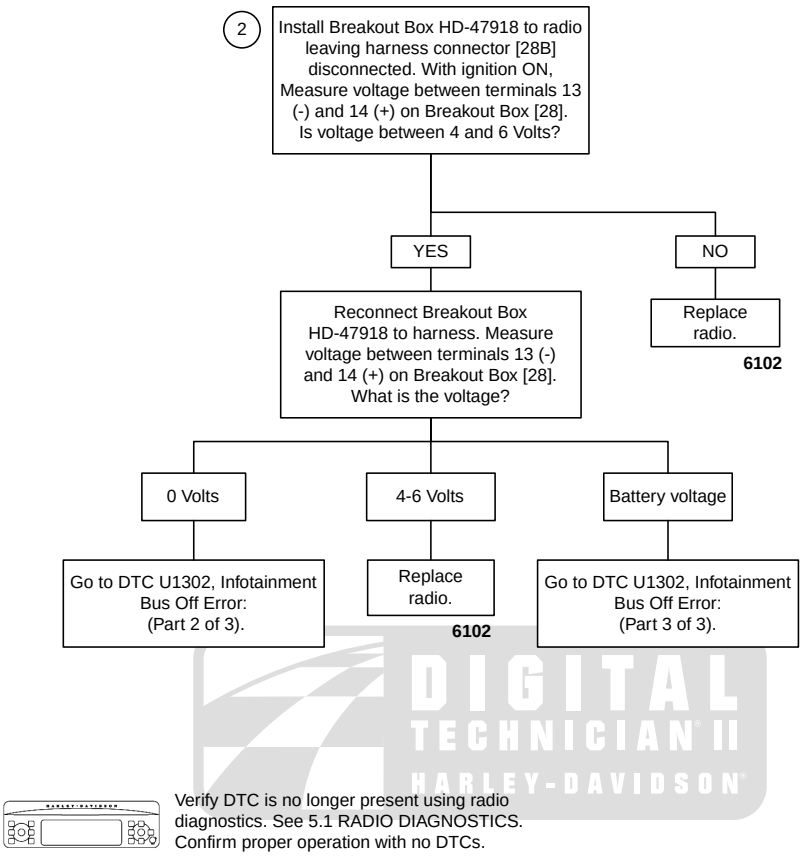
DTC U1300 and U1301, J1850 Bus Shorted Low and Bus Shorted High



Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02306_en

DTC U1302, Infotainment Bus Off Error (Part 1 of 3)



Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02307_en

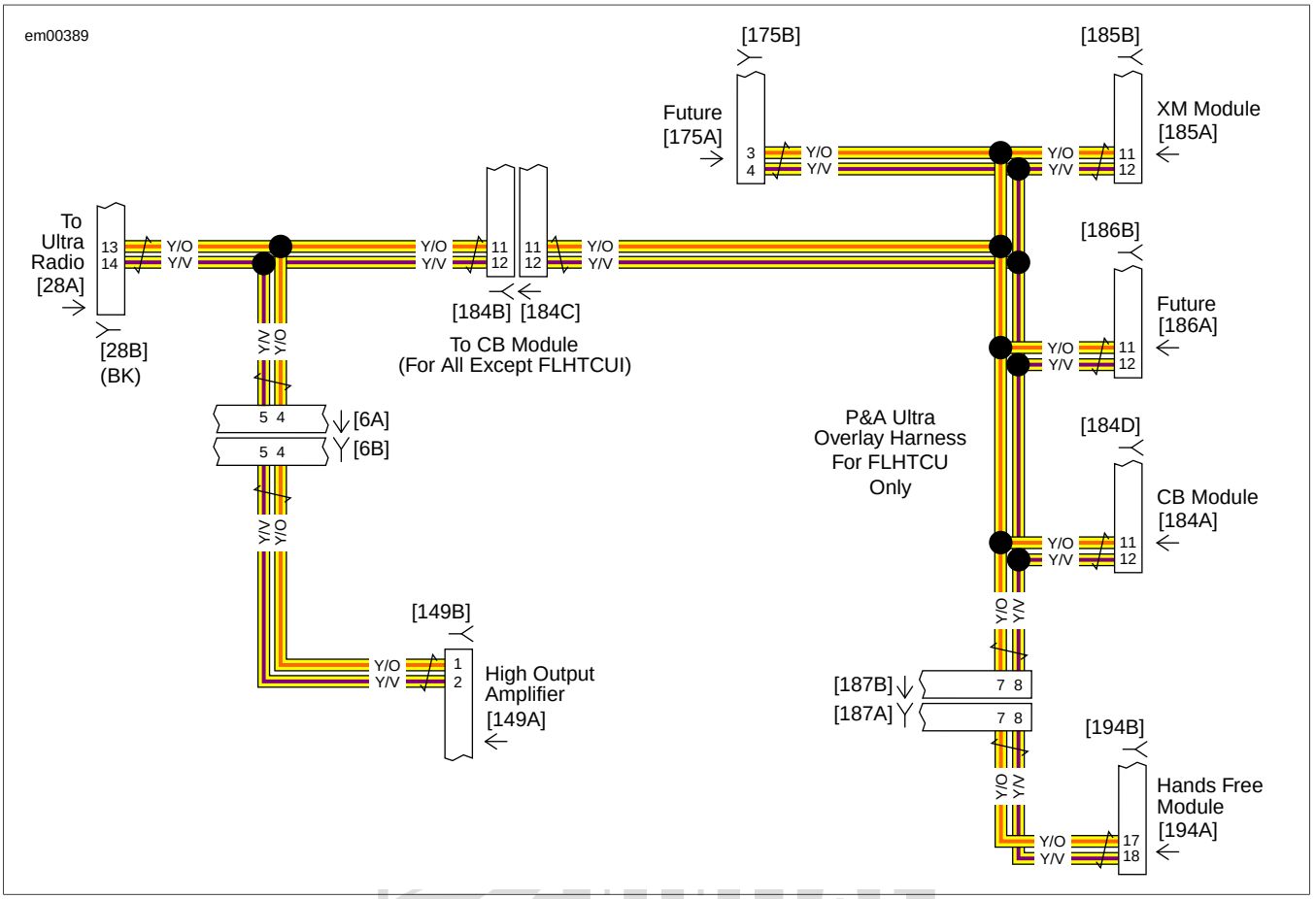
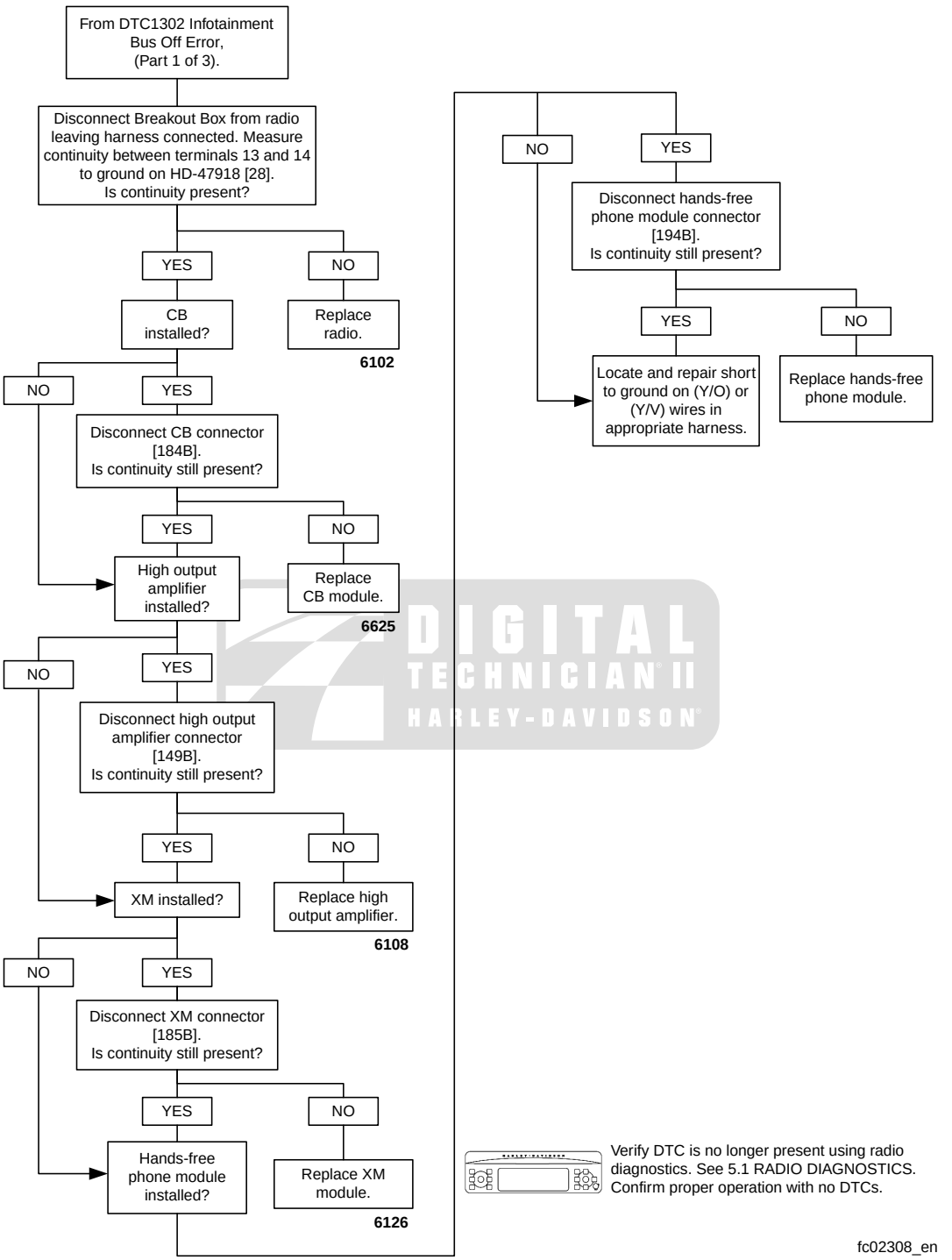


Figure 5-25. Infotainment BUS Circuit

Table 5-29. Wire Harness Connectors

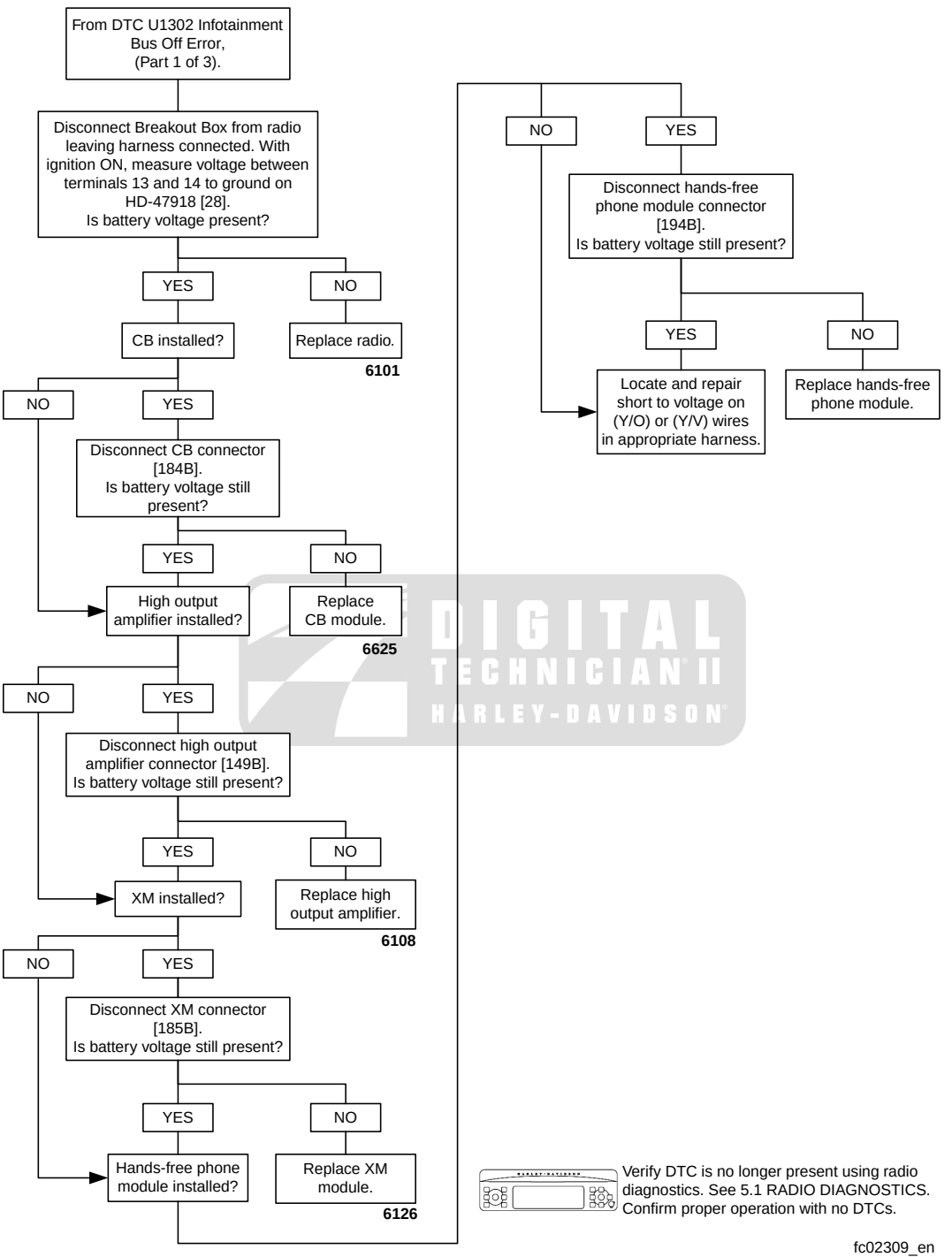
NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect harness	6-Place Deutsch (Black)	Inner fairing - left side of radio
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[149]	High output amplifier	23-Place Amp	Under luggage rack (right side)
[175]	Future	-	-
[184]	CB module	12-Place Mini-Deutsch	Inner fairing - left side of radio
[185]	XM module	12-Place Mini-Deutsch	Inner fairing - top of radio
[186]	Future	-	-
[187]	Hands-free phone module	12-Place Mini-Deutsch	Inner fairing - top of radio (left side)
[194]	Hands-free phone module	54-Place Amp	Inside TourPak (left side)

DTC U1302, Infotainment Bus Off Error (Part 2 of 3)



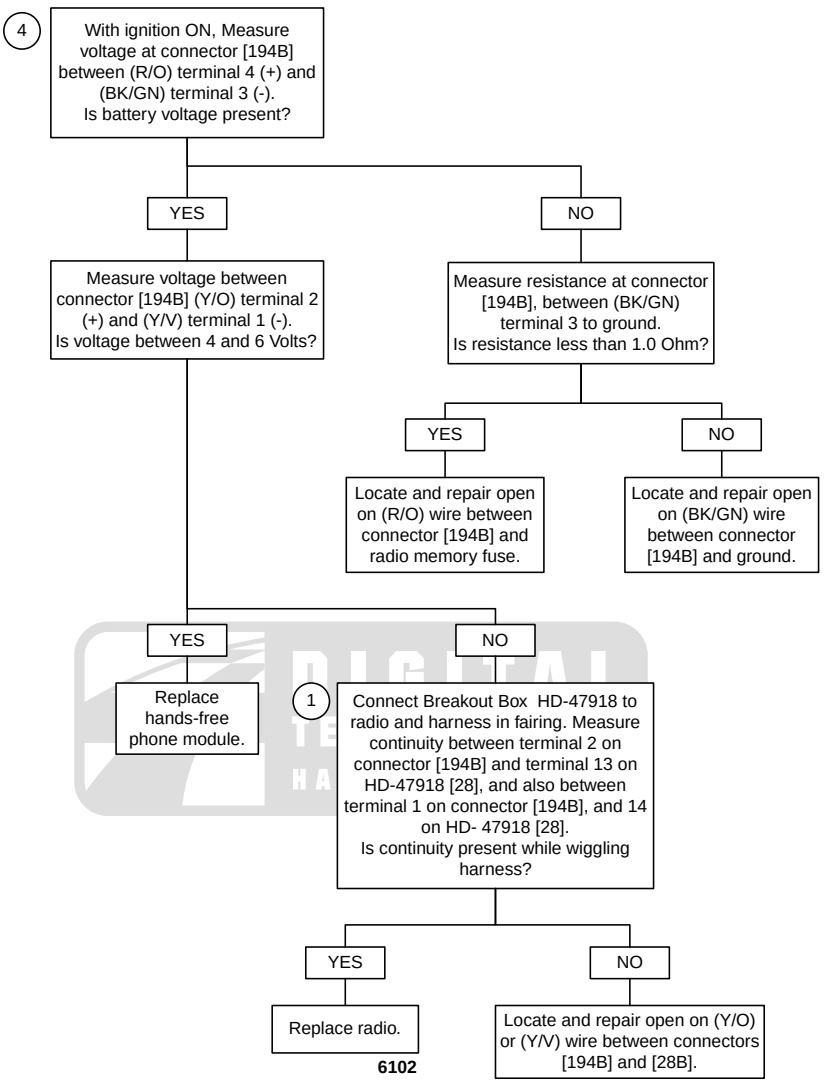
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

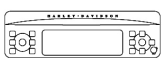
DTC U1302, Infotainment Bus Off Error (Part 3 of 3)



DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC U1306, Infotainment Bus Lost Communications with Hands-Free Phone Module





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02310_en

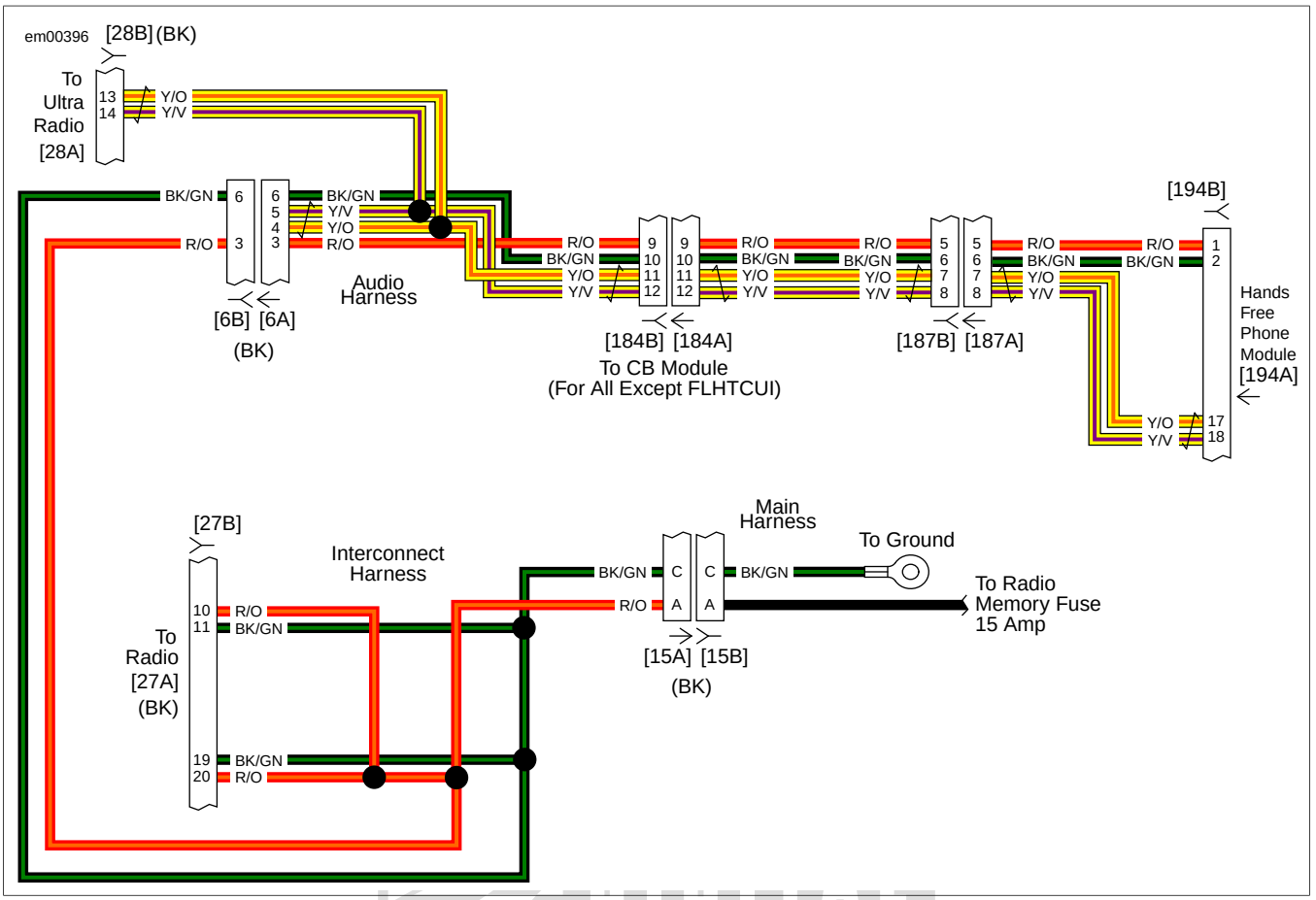
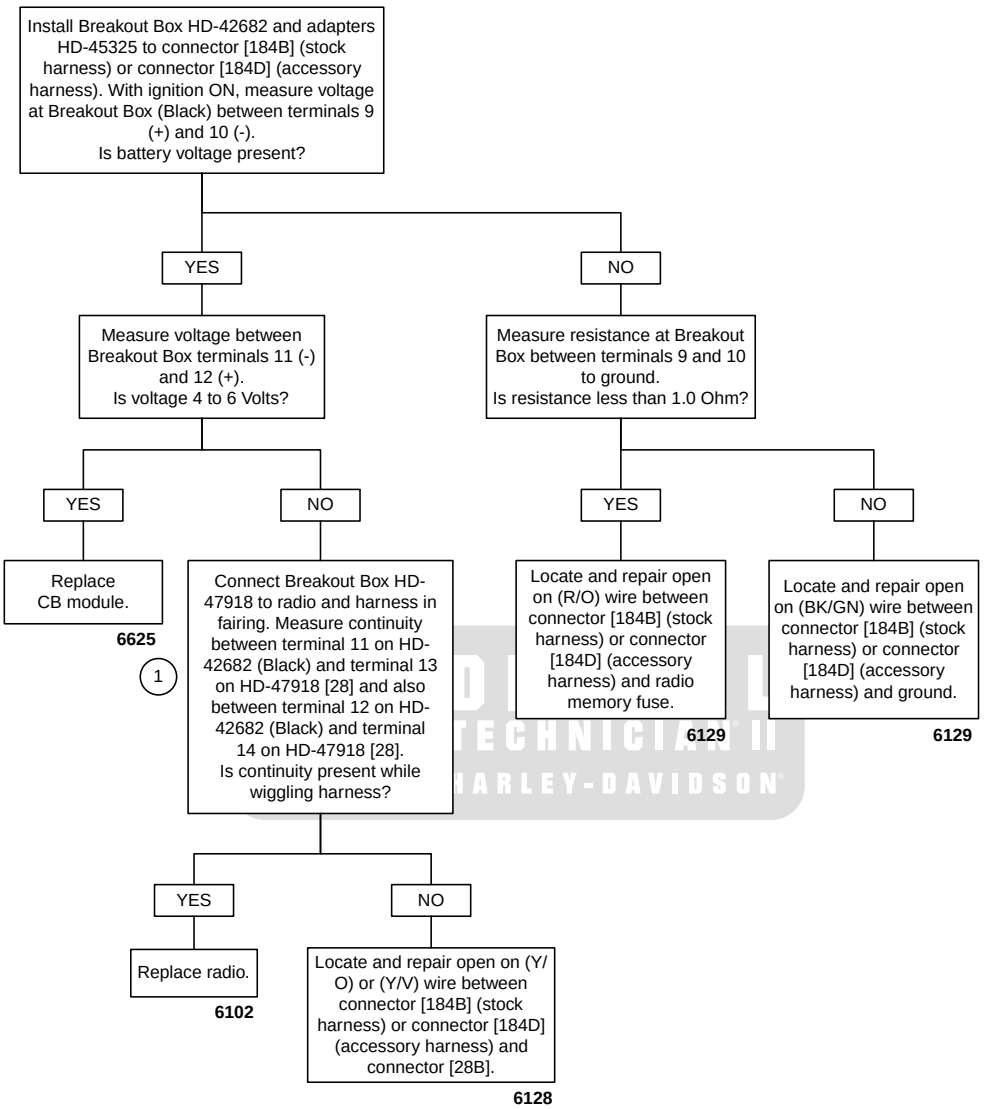


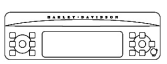
Figure 5-26. Hands-Free Phone Circuit

Table 5-30. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect harness	6-Place Deutsch (Black)	FLHTC/U/X - Inner fairing - left side of radio FLTR - Inner fairing right side below radio
[15]	Main to interconnect harness	4-Place Packard	FLHTC/U/X - Inner fairing - right fairing bracket FLTR - Inner fairing right side below radio
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[187]	Hands-free phone module	12-Place Mini-Deutsch	Inner fairing - top of radio (left side)
[194]	Hands-free phone module	54-Place Amp	Inside TourPak (left side)

DTC U1307, Infotainment Bus Lost Communications with CB





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02311_en

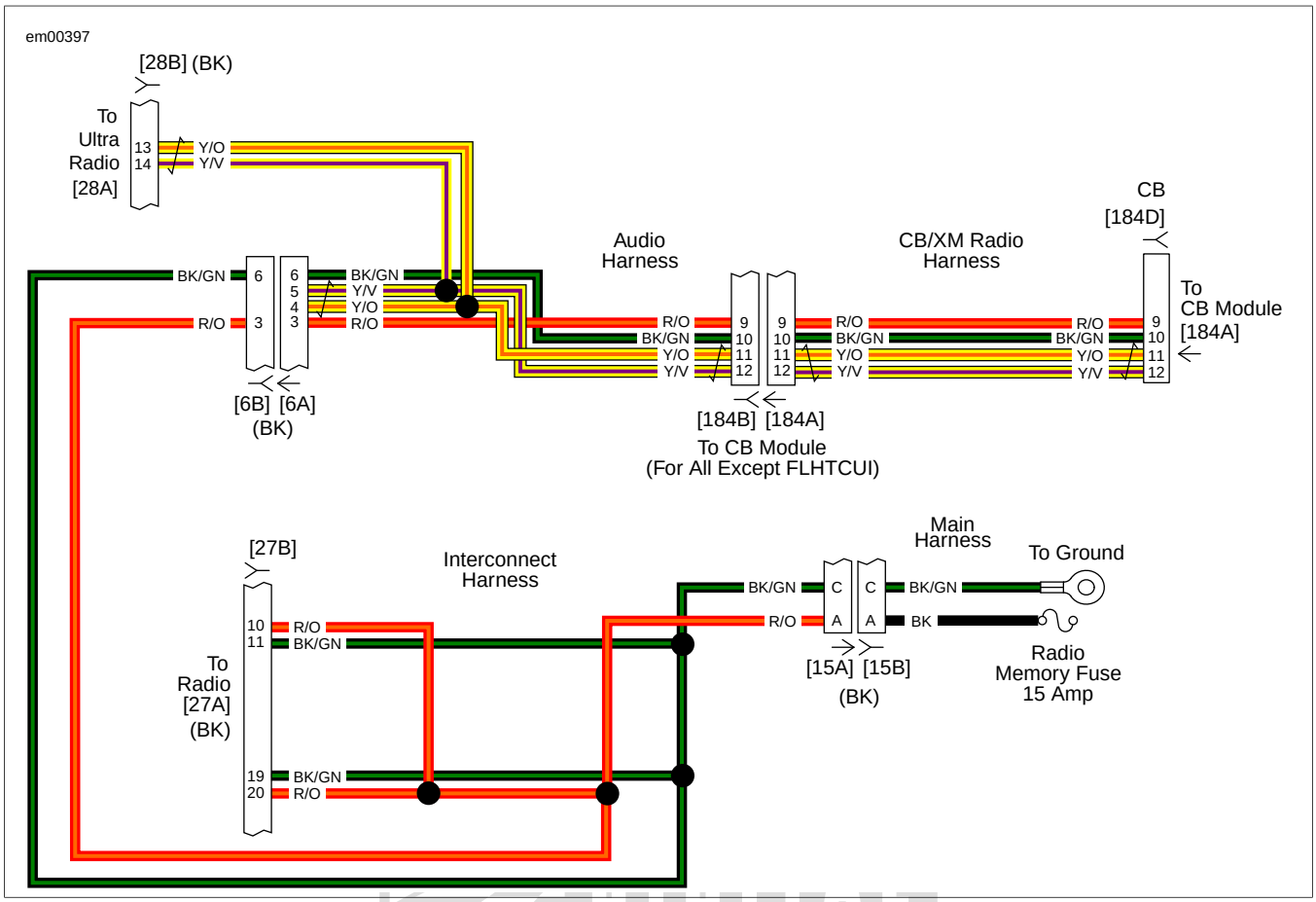
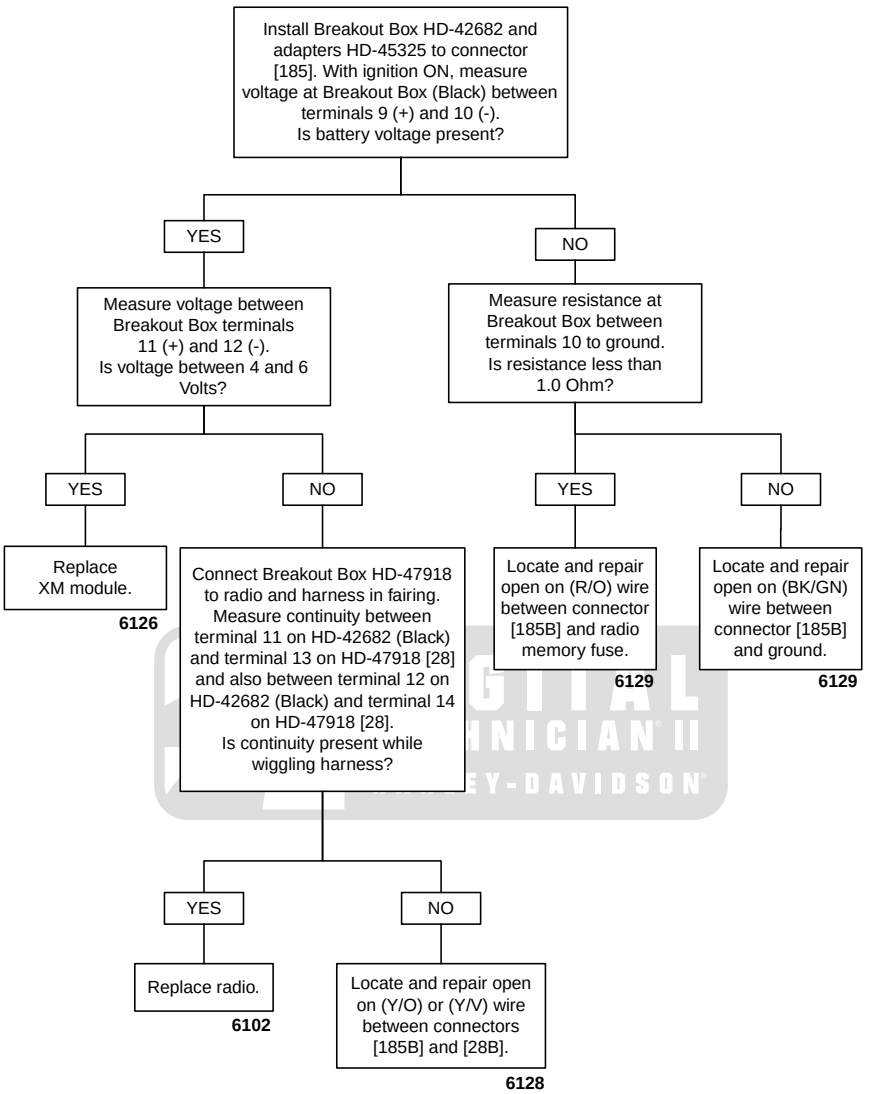


Figure 5-27. CB Circuit

Table 5-31. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect harness	6-Place Deutsch (Black)	FLHTC/U/X - Inner fairing - left side of radio FLTR - Inner fairing right side below radio
[15]	Main to interconnect harness	4-Place Packard	FLHTC/U/X - Inner fairing - right fairing bracket FLTR - Inner fairing right side below radio
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[184]	CB module	12-Place Mini-Deutsch	Inner fairing - left side of radio

DTC U1313, Infotainment Bus Lost Communications with XM





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02312_en

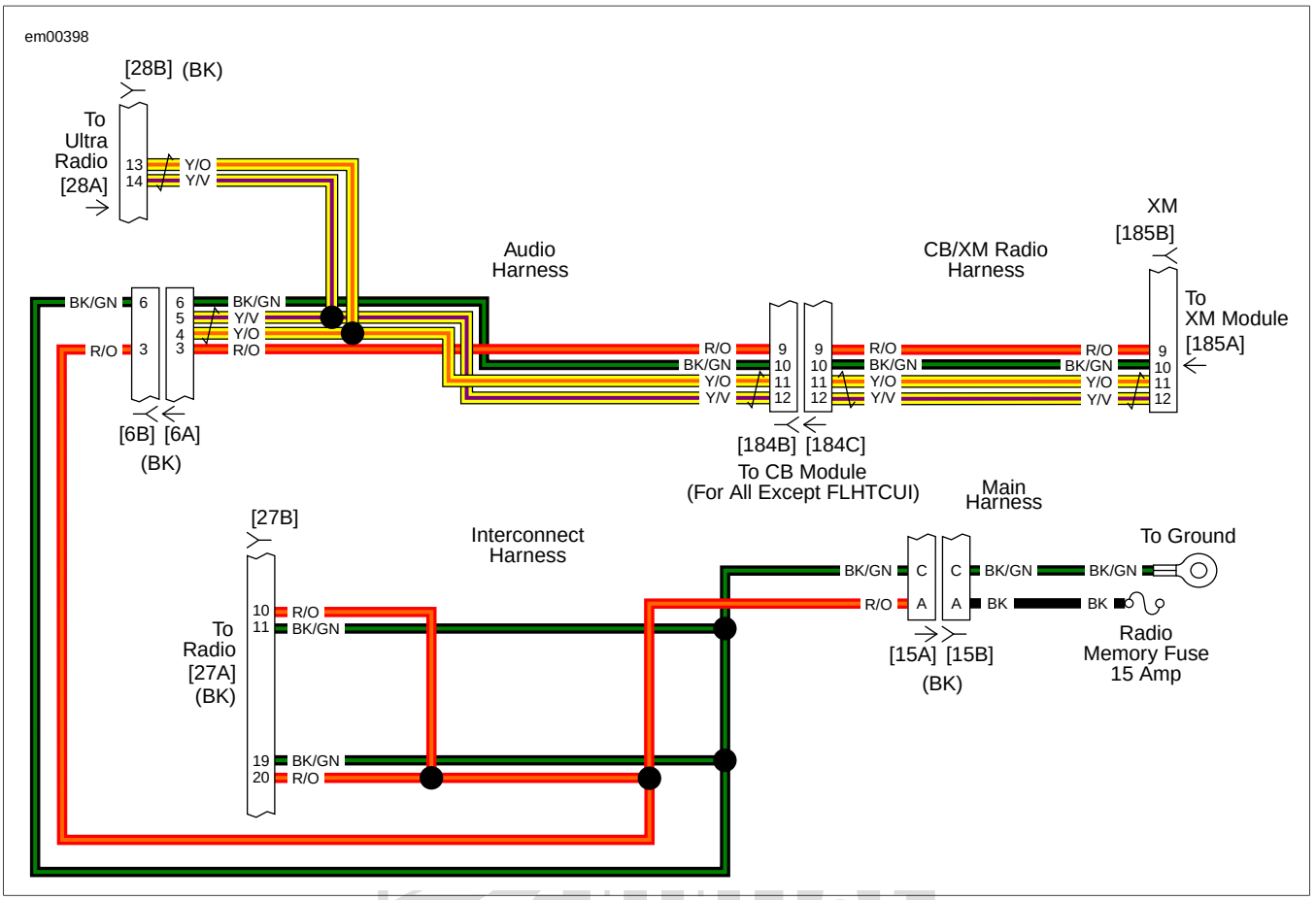
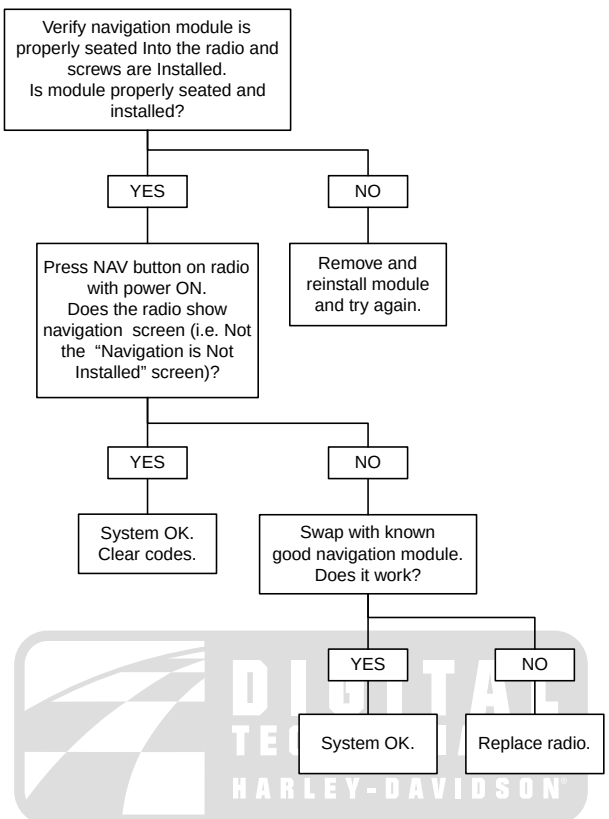


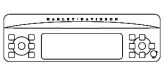
Figure 5-28. XM Circuit

Table 5-32. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect harness	6-Place Deutsch (Black)	FLHTC/U/X - Inner fairing - left side of radio FLTR - Inner fairing right side below radio
[15]	Main to interconnect harness	4-Place Packard	FLHTC/U/X - Inner fairing - right fairing bracket FLTR - Inner fairing right side below radio
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[185]	CB module	12-Place Mini-Deutsch	Inner fairing - top of radio (left side)

DTC U1314, Infotainment Bus Lost Communications with Navigation

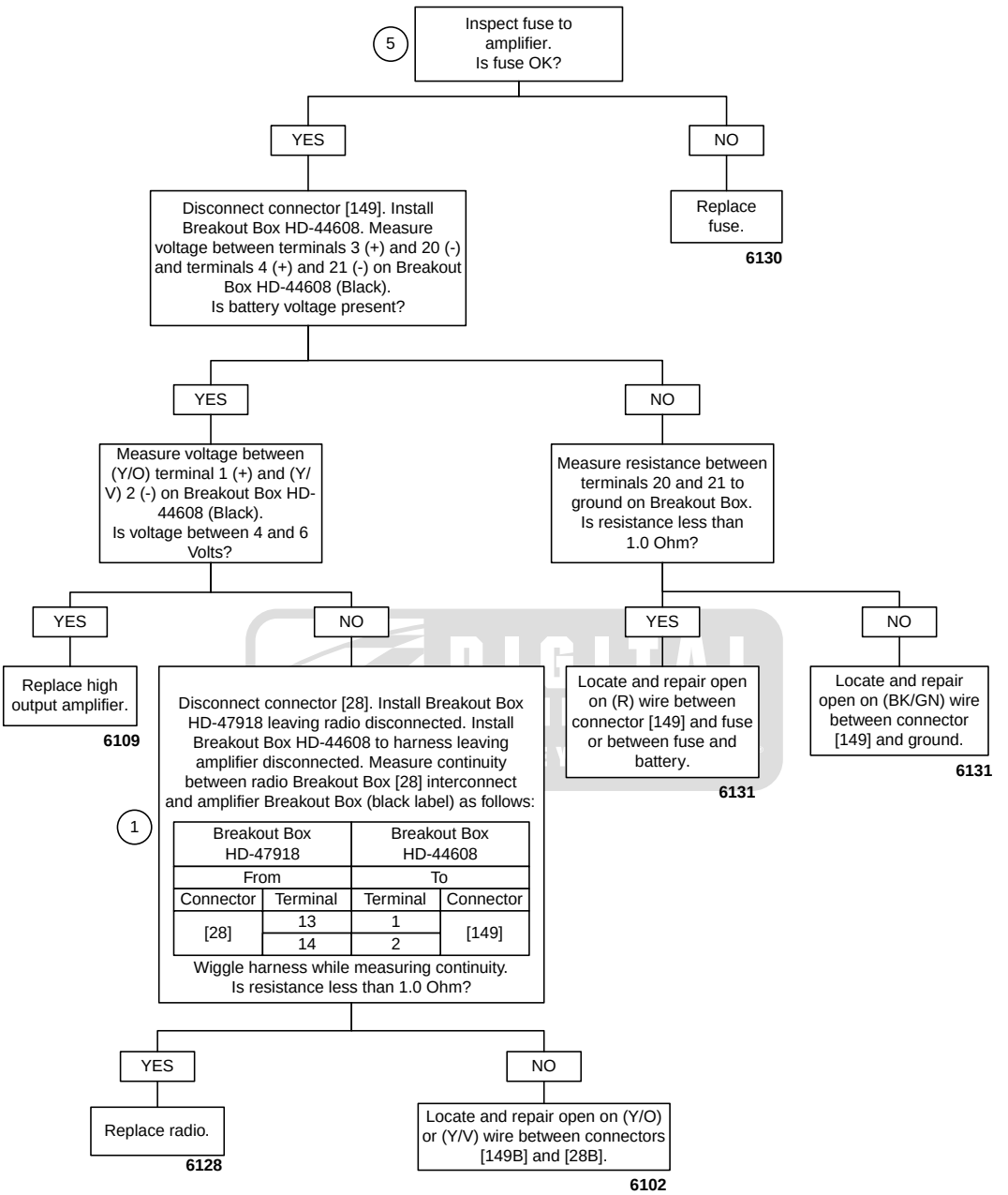


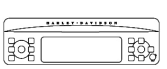


Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02313_en

DTC U1317, Infotainment Bus Lost Communications with High Output Amplifier





Verify DTC is no longer present using radio diagnostics. See 5.1 RADIO DIAGNOSTICS. Confirm proper operation with no DTCs.

fc02314_en

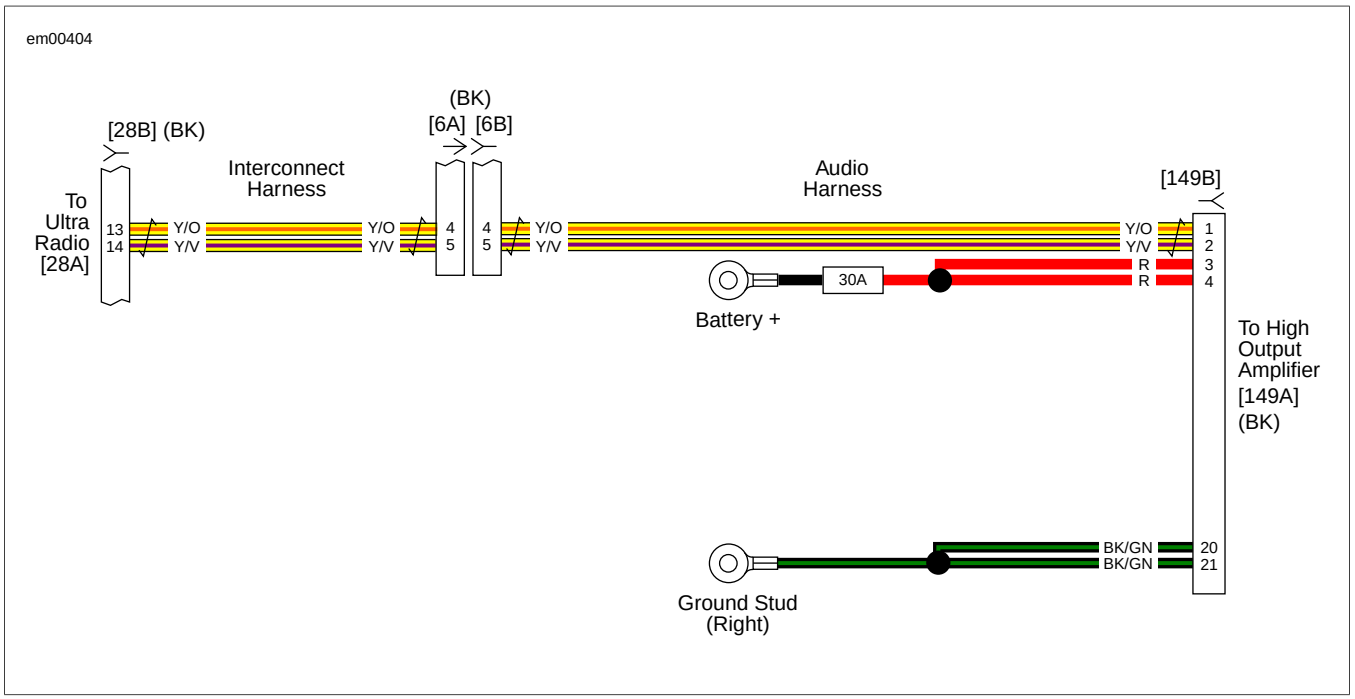


Figure 5-29. High Output Amplifier Circuit

Table 5-33. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect harness	6-Place Deutsch (Black)	FLHTC/U/X - Inner fairing - left side of radio FLTR - Inner fairing right side below radio
[28]	Radio	35-Place Amp	Inner fairing - back of radio (right side)
[149]	High output amplifier	23-Place Amp	Under luggage rack (right side)

ADVANCED AUDIO SYSTEM SYMPTOMS 5.5

GENERAL

A number of faults may occur that will not set a DTC. These faults are listed in Table 5-34.

Table 5-34. Advanced Audio System Symptoms

NO.	SYMPTOM	TEST
1	Radio Inoperative	Radio Inoperative: Symptom 1
2	Poor or No Reception	Poor or No Reception: Symptom 2
3	Static Present with Engine Running	Static Present with Engine Running: Symptom 3
4	CB Transmitter Inoperative and SWR Adjustment	CB Transmitter Inoperative: Symptom 4 (Part 1 of 4)
5	CB Receiver Inoperative	CB Receiver Inoperative: Symptom 5 (Part 1 of 3)
6	Intercom Inoperative	Intercom Inoperative: Symptom 6
7	Handheld Microphone/PTT Inoperative	Handheld Microphone/PTT Inoperative: Symptom 7 (Part 1 of 2)
8	Speaker Switch Malfunction	Speaker Switch Malfunction: Symptom 8
9	Headset Speakers Inoperative	Headset Speakers Inoperative: Symptom 9 (Part 1 of 5)
10	No or Low Audio From Microphones	No or Low Audio From Microphones: Symptom 10 (Part 1 of 4)
11	No or Low Audio With High Output Amplifier	No or Low Audio With High Output Amplifier: Symptom 11
12	No or Low Audio From XM or XM Inoperative	No or Low Audio From XM or XM Inoperative: Symptom 12 (Part 1 of 2)
13	XM - No or Intermittent Reception	XM - No or Intermittent Reception: Symptom 13
14	Navigation Inoperative	Navigation Inoperative: Symptom 14 (Part 1 of 2)
15	AVC Inoperative	AVC Inoperative: Symptom 15
16	Handlebar, Passenger or Sidecar Switches Inoperative	Handlebar, Passenger or Sidecar Switches Inoperative: Symptom 16 (Part 1 of 4)
17	CD Skipping	CD Skipping: Symptom 17
18	Hands-Free Phone Module Inoperative No or Low Audio To Hands-Free Phone Module No or Low Audio From Hands-Free Phone Module Hands-Free Phone Module - Phone Not Pairing	Hands-Free Phone Module Initial Diagnostics: Symptom 18 (Part 1 of 5)

FACTORY DEFAULTS

If a symptom is present without a DTC, restoring ROM defaults back to the factory settings may resolve the issue, which can sometimes be caused by a unique sequence of rider interactions with the system.

NOTE

On FLHTCU models, set Intercom, VOX and CB squelch to midpoint and turn Weather Alert to OFF.

Access the radio diagnostic display and press softkey 1 (DEFAULT), or proceed as follows:

1. Turn the ignition ON with the radio OFF.
2. Push and hold softkeys 1 and 3 and OK for 2 seconds.
3. Push the arrow up 2 times.
4. Push softkey 2.
5. Turn off ignition for more than 20 seconds.
6. Turn ignition on and verify all defaults have reset.

The following are reset to the factory ROM defaults:

- radio presets
- volume levels, bass, treble, AVC, fader and VOX
- display contrast
- external amplifier present is reset to no amplifier (if an external amplifier is present, it will take two long ignition cycles before the radio is set up to enable the external amplifier)
- CB or PHONE present is reset to no phone (this is used by the radio to enable the intercom setting if a CB or phone are present, and like the amplifier, it will take two long

ignition cycles before the radio completely enables the intercom)

- all DTCs are reset
- navigation saved data. This data is immediately updated upon navigation startup, so the user should be unaffected

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-39448	DUMMY LOAD
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-47918	RADIO BREAKOUT BOX
HD-48037	SWR METER ADAPTERS

Before proceeding with the diagnostics, make sure the radio is calibrated, any CD has been removed from the CD player, and the audio levels from auxiliary devices are set to not greater than 2 Volts at the input to the ultra radio. Doing so can reduce or eliminate needless troubleshooting of these symptoms.

If a CD is stuck in the player, the player must be reset. Remove the MAXIFUSE and wait 5 minutes. Turn radio power ON and press the EJECT button. If the CD does not eject after performing the reset procedure, the radio is faulty and must be replaced.

Diagnostic Tips

Reading and understanding these Diagnostic Tips will help make troubleshooting symptomatic problems easier.

1. If radio is uncalibrated, CB is not functional. If the CB is not allowed in a region (Japan, for example), then the unit will not operate.
2. Remove outer fairing. Disconnect antenna connector from CB and replace it with a DUMMY LOAD (Part No. HD-39448).

NOTE

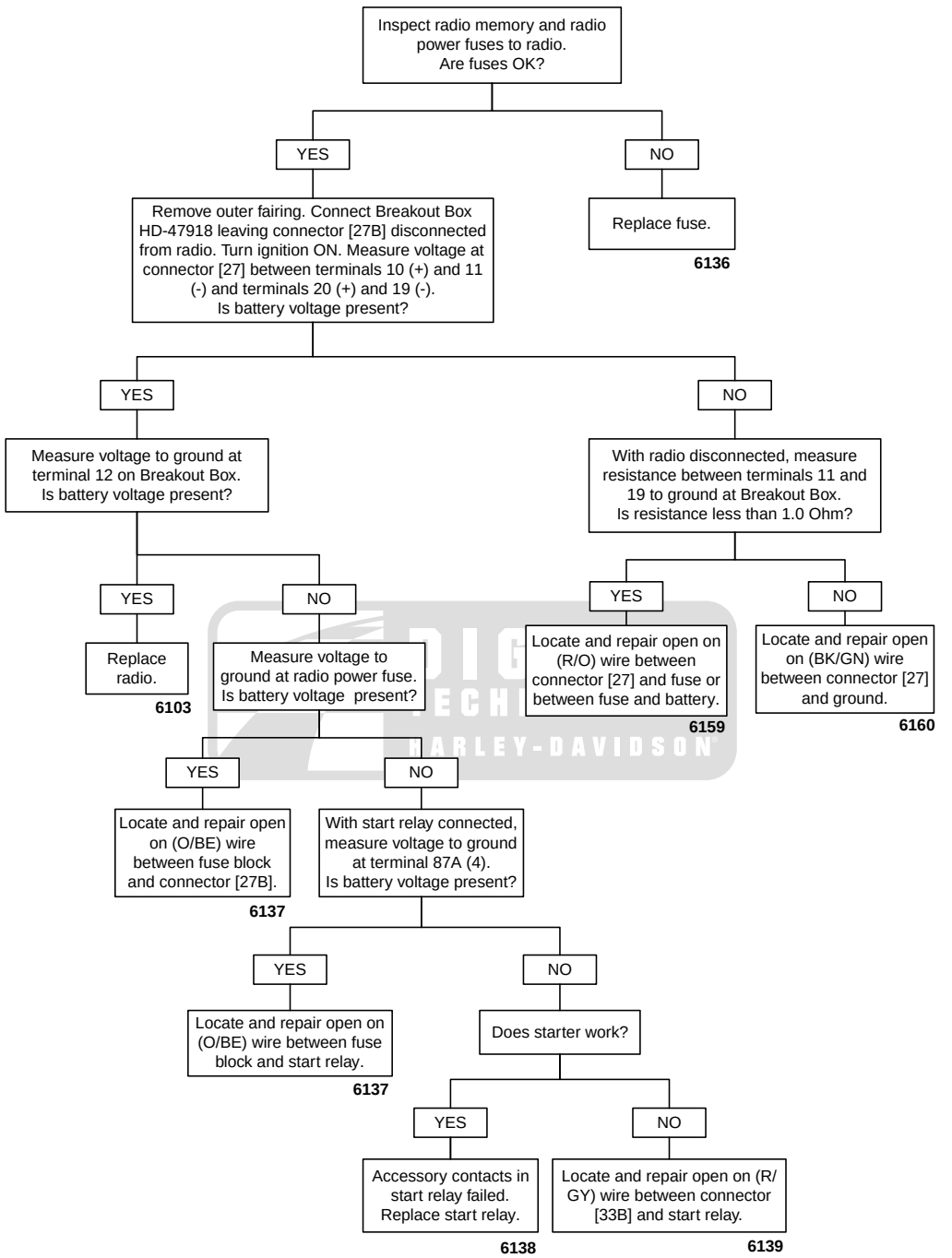
The lamp acts as a load allowing the CB to be operated and provides a means of checking relative power output and modulation.

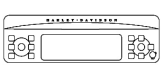
3. To use the dummy load, screw the lamp onto the antenna jack of the CB using the appropriate SWR METER ADAPTERS (Part No. HD-48037). Press the PTT switch. If the CB is transmitting a carrier wave, the lamp should illuminate. Speaking into the microphone should cause the lamp to flicker. It should get brighter and dimmer depending on how loud your voice is. A change in lamp brilliance means the CB is modulating.
4. Install RADIO BREAKOUT BOX (Part No. HD-47918).
5. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), black pin probes, socket probes, and patch cords.
6. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), black socket probes and patch cord.
7. Part No. 70172-06 CVO CB/XM Y-Harness used on stock FLHTCUSE4.
8. Part No. 70164-06 Ultra Overlay Harness used on upgraded FLHTCUSE4.
9. Part No. 70169-06 Non-Ultra Overlay Harness used on upgraded FLHX, FLHTC and FLTR.
10. Part No. 70160-06 Audio Harness used on FLHTCU and FLHTCUSE4.
11. The amplifier fuse is an inline fuse for all accessory installations and is mounted in the fuse block for FLHTCUSE4 models.
12. It is possible to have a fault on more than one handlebar control as a result of the following configuration:

- Terminal 5 (V/BK) wire is common to both the PTT/Squelch and Mode handlebar controls.
- Terminal 8 (BN/BK) wire is common to both the PTT/Squelch and Audio handlebar controls.
- Terminal 22 (GY/GN) wire is common to both the PTT/Squelch and Audio handlebar controls.

13. Terminal 3 (PK/W) wire is common to both the Mode and Audio handlebar controls. Therefore, it is possible to have a fault on more than one handlebar control as a result of this configuration.
14. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown pin probe and patch cord.
15. Some aftermarket exhaust systems may cause excessive pressure on the rear mounts causing the exhaust system to be put into a bind creating excessive vibration the CD player may not be able to isolate.
16. This 18-place connector is located on the hands-free phone module. Disconnect the connector and GENTLY touch the probes to the terminals to make the measurement.
17. When prompt button is pressed, allow 10 seconds for voice prompt to respond.

Radio Inoperative: Symptom 1





Confirm proper operation with no DTCs.

fc02315_en

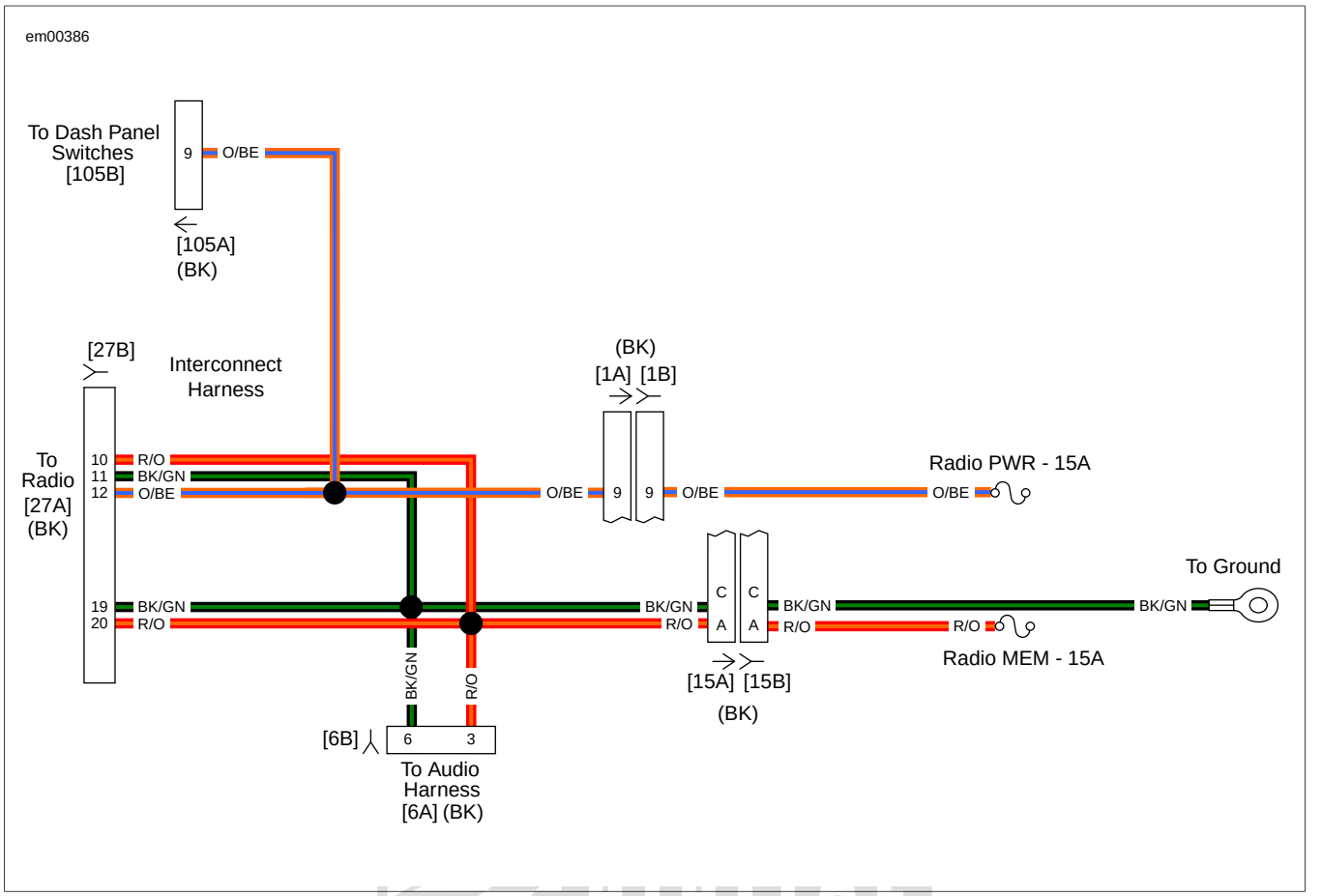
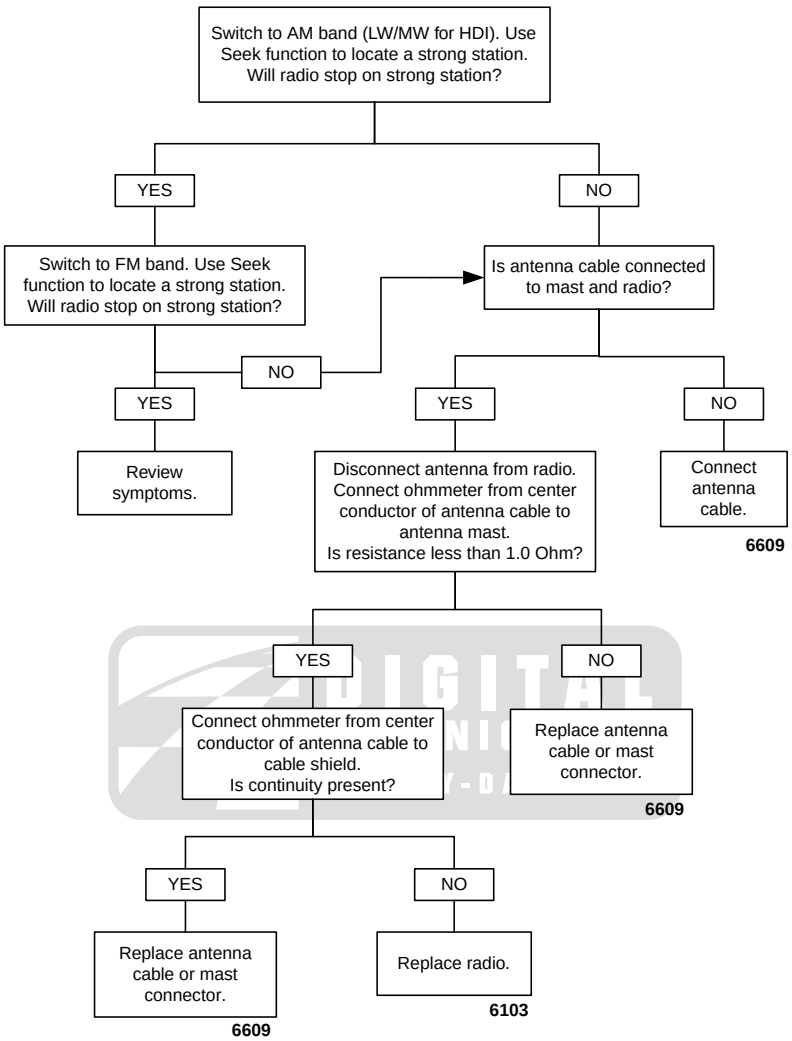


Figure 5-30. Radio Power

Table 5-35. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-Place Molex	FLHTC/U/X - Inner fairing right radio support bracket FLTR - Inner fairing right side below radio
[6]	Audio to interconnect harness	6-Place Deutsch (Black)	FLHTC/U/X - Inner fairing left side of radio FLTR - Inner fairing right side below radio
[15]	Main to interconnect harness	4-Place Packard	FLHTC/U/X - Inner fairing right fairing bracket FLHT - Inner fairing right side below radio
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[64-2]	Start relay	Fuse block	In fuse block under left side cover
[105]	Fairing cap switches	12-Place Multilock	FLHTC/U/X - Inner fairing above upper fork bracket (right side) FLTR - Under instrument bezel

Poor or No Reception: Symptom 2



Confirm proper operation with no DTCs.

Fc02316_en

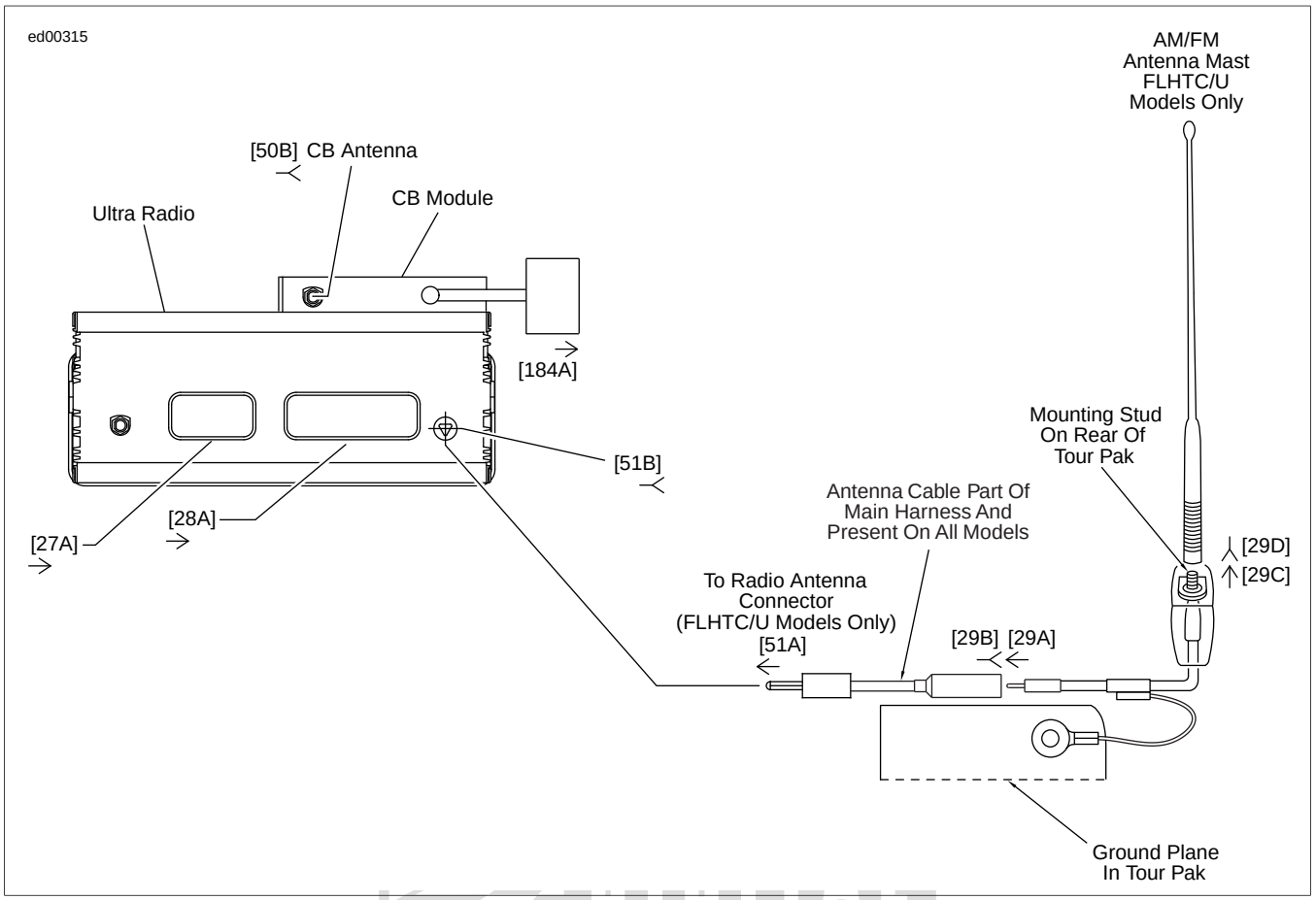
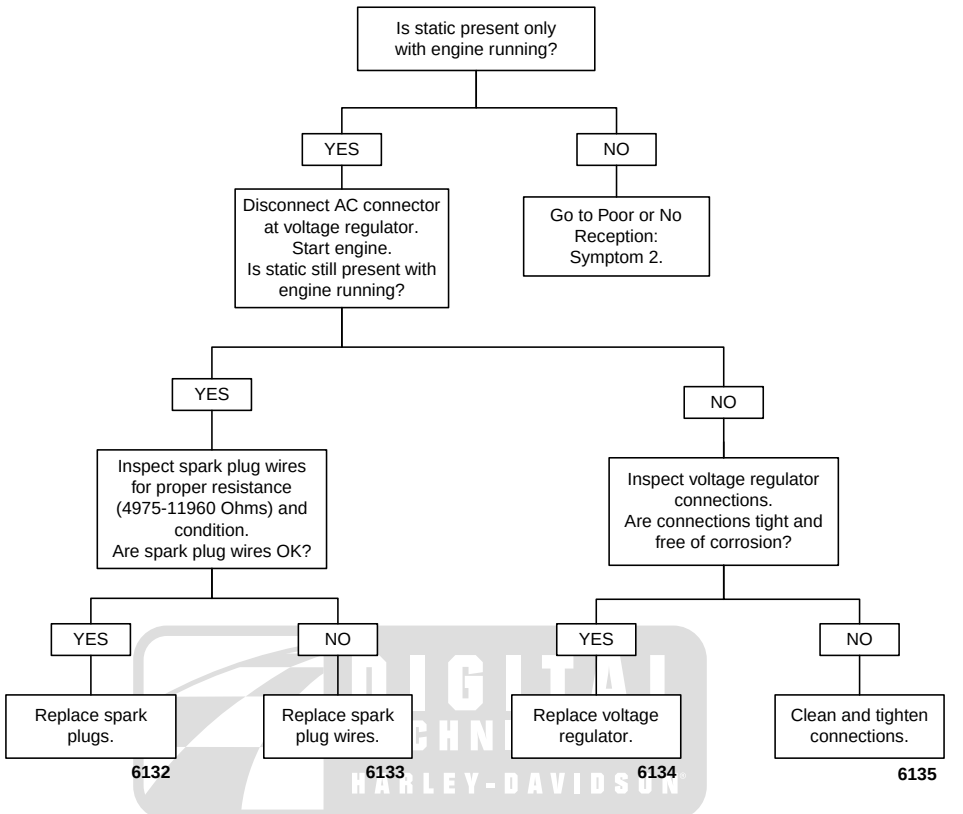
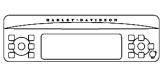


Figure 5-31. Radio Antenna Cable and Mast

Static Present with Engine Running: Symptom 3

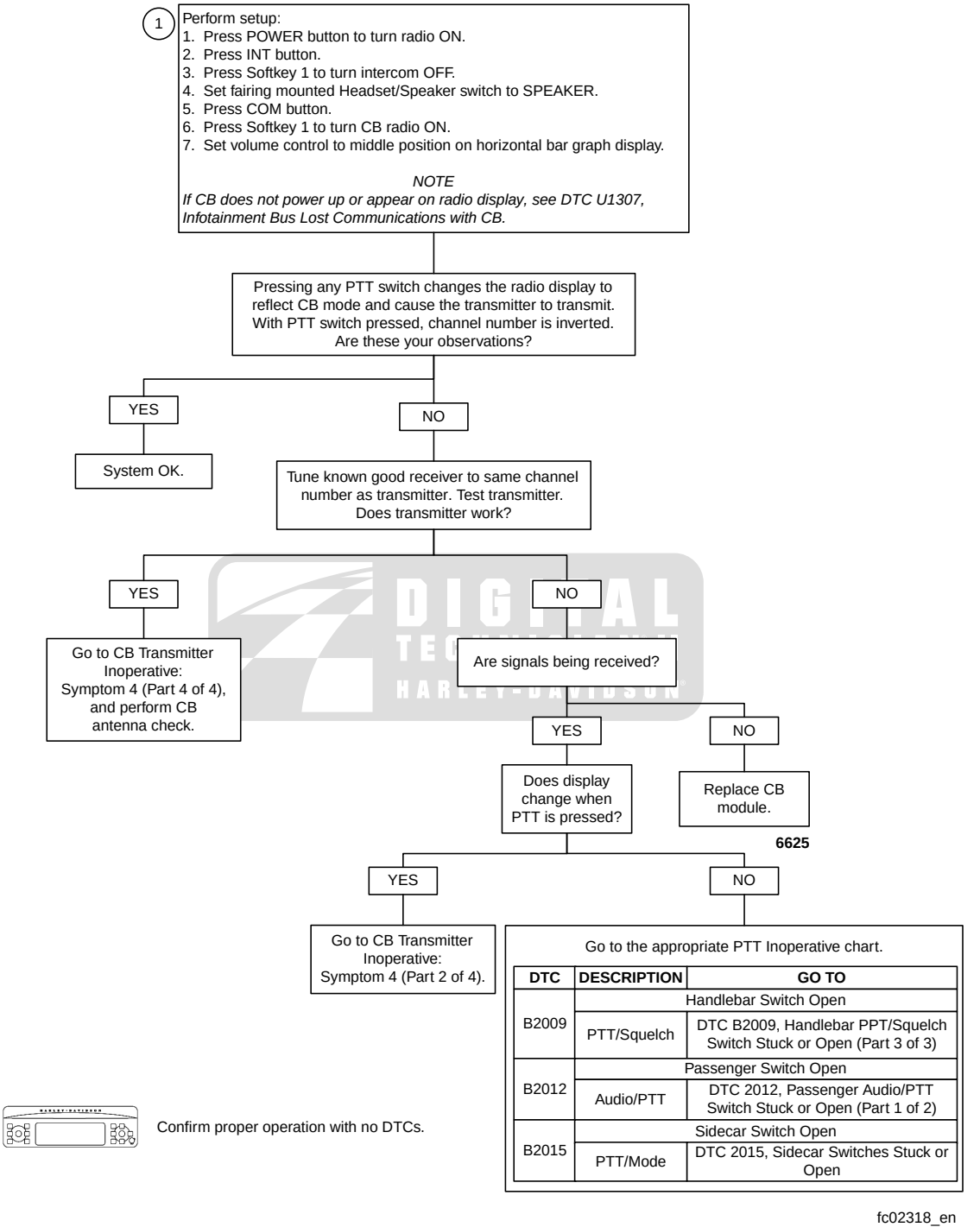




Confirm proper operation with no DTCs.

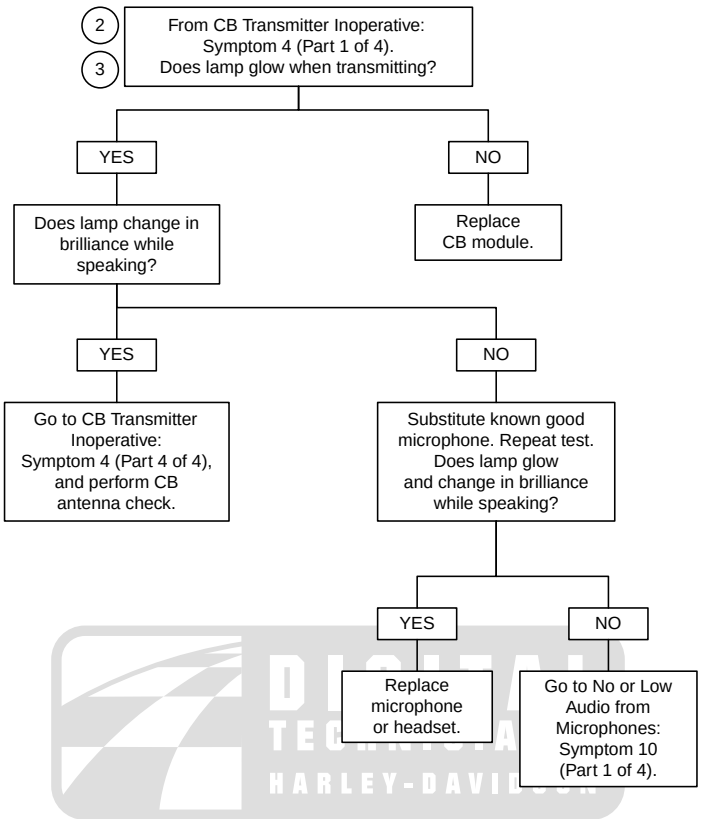
fc02317_en

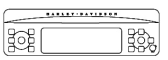
CB Transmitter Inoperative: Symptom 4 (Part 1 of 4)



fc02318_en

CB Transmitter Inoperative: Symptom 4 (Part 2 of 4)





Confirm proper operation with no DTCs.

fc02319_en

CB Transmitter Inoperative: Symptom 4: SWR Adjustment (Part 3 of 4)

CAUTION

Do not press PTT switches with antenna and SWR meter disconnected. Transceiver damage could result. (00522b)

Standing Wave Ratio (SWR) is a technical term for the procedure that checks how well the CB transmitter and antenna are matched. The SWR should be 2:1 or below on channel 20. A SWR of 1:1 is optimum. To check SWR, a SWR meter or bridge is required. Your Harley-Davidson dealer will either have a SWR meter or direct you to a CB repair shop for a SWR check. Since the operating procedures for SWR meters vary, be sure you carefully follow the operating instructions for the SWR meter being used.

1. Locate motorcycle outdoors or in a building with a ceiling of 11 ft. (3.4 m) minimum above floor. Also, there must be 8 ft. (2.4 m) of radial clearance around motorcycle. Adjusting the SWR in an area with a lower ceiling and/or less radial clearance may result in an inaccurate adjustment.
2. Remove the outer fairing. Obtain Radio Shack SWR Meter (Part No. 21-534) or equivalent and SWR METER ADAPTERS (Part No. HD-48037). Remove the antenna cable and connect the SWR meter to the CB module. Connect the antenna cable to the SWR meter.
3. Check that antenna mast is threaded securely on to base and set screw is tight.
4. Before measuring the SWR, the SWR meter must be calibrated. Follow the instructions for the meter being used. The following procedure is the general calibration most meter instructions specify.

NOTE

Do not touch the antenna or meter during calibration or SWR measurement. Move CAL knob and then move your hand away from meter while calibrating.

5. With ignition and CB switches ON, the SWR meter set on "FWD", channel 20 selected, press either PTT switches. Hold the PTT switch and rotate the calibration (CAL) control until the meter needle aligns with the "CAL" mark.
6. Release the PTT switch and move the FWD/REF switch to "REF" (reflected).
7. Press and hold either PTT switch. The meter reading is the SWR.
8. If SWR is more than 3:1, remove antenna cable from CB module. Using clip-on test leads, connect one lead of ohmmeter to center pin in antenna lead and other lead to antenna mast. Meter must read 1 Ohm or less. Wiggle or flex mast while observing meter. If resistance is more than 1 Ohm or varies when mast is wiggled, replace mast. If the SWR is less than 3:1, loosen antenna set screw and change mast length.
9. Repeat Step 8. If SWR became higher, adjust antenna mast in opposite direction. Continue adjusting antenna until the minimum SWR is achieved. If you cannot obtain an SWR of 2:1 or less by adjusting the antenna length, make the mast shorter to improve the SWR. Remove mast and use grinder to shorten mast (grind in small increments). If SWR cannot be adjusted to less than 2:1, see CB TRANSMITTER INOPERATIVE (Part 4 of 4).
10. After SWR is adjusted on channel 20, check SWR on channels 1 and 40. Adjust the mast length to obtain a balance between channels 1 and 40.

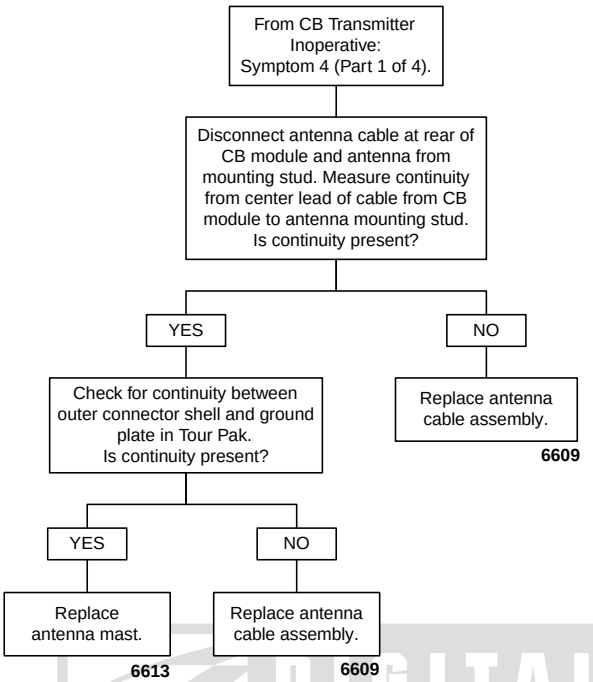
NOTE

Check the SWR if a luggage rack is installed on the Tour-Pak cover. Be sure the Tour-Pak cover is closed when the check is performed. Accessories mounted on the Tour Pak may affect the SWR reading and broadcast range, so the luggage rack should be mounted as far forward as possible. The Ultra Tour-Pak chrome accent rail also can adversely affect SWR.

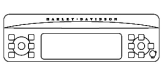


Figure 5-32. SWR Meter Adapters (Part No. HD-48037)

CB Transmitter Inoperative: Symptom 4 (Part 4 of 4)



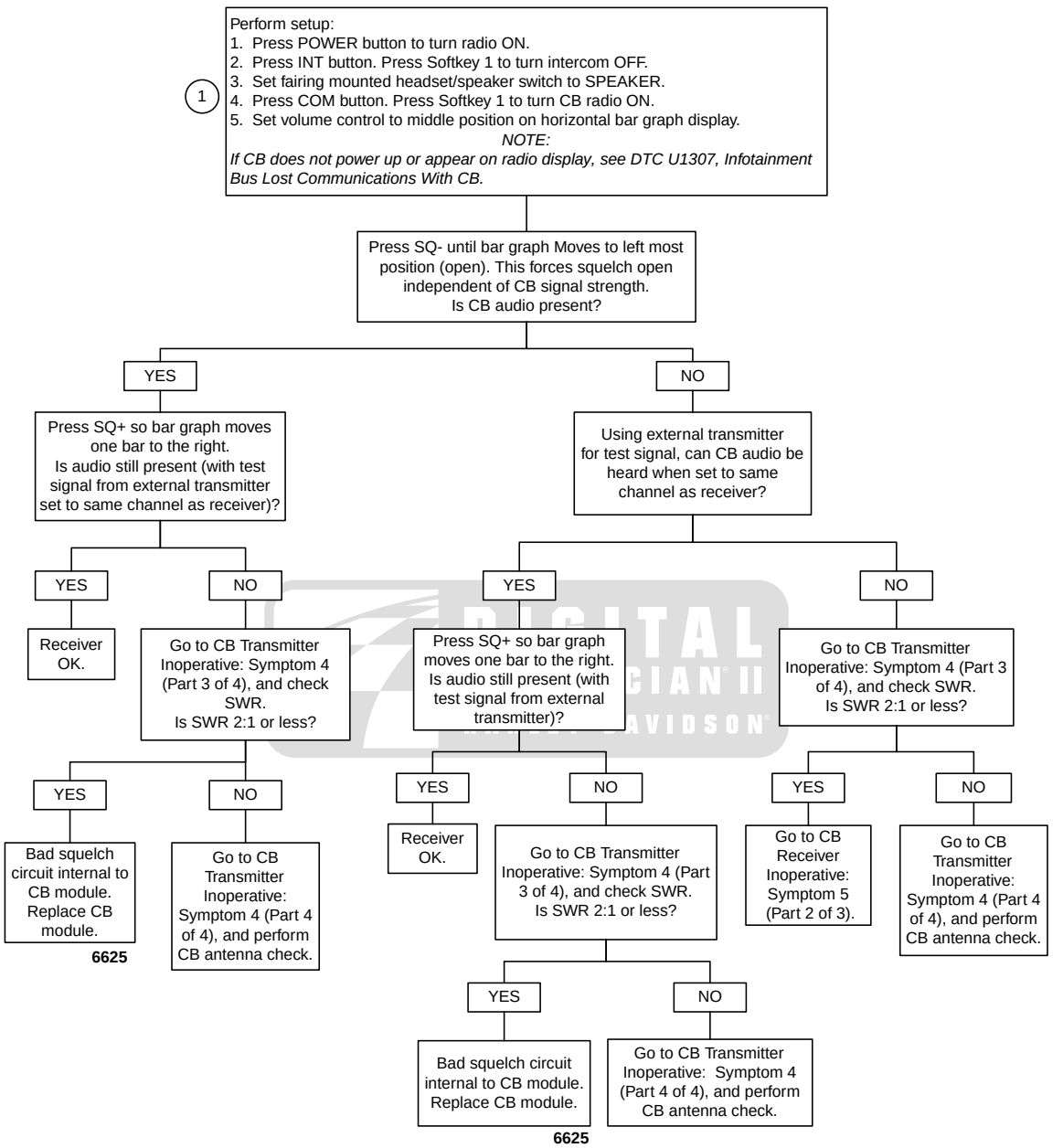
DIGITAL TECHNICIAN II HARLEY-DAVIDSON



Confirm proper operation with no DTCs.

fc02320_en

CB Receiver Inoperative: Symptom 5 (Part 1 of 3)



Confirm proper operation with no DTCs.

fc02321_en

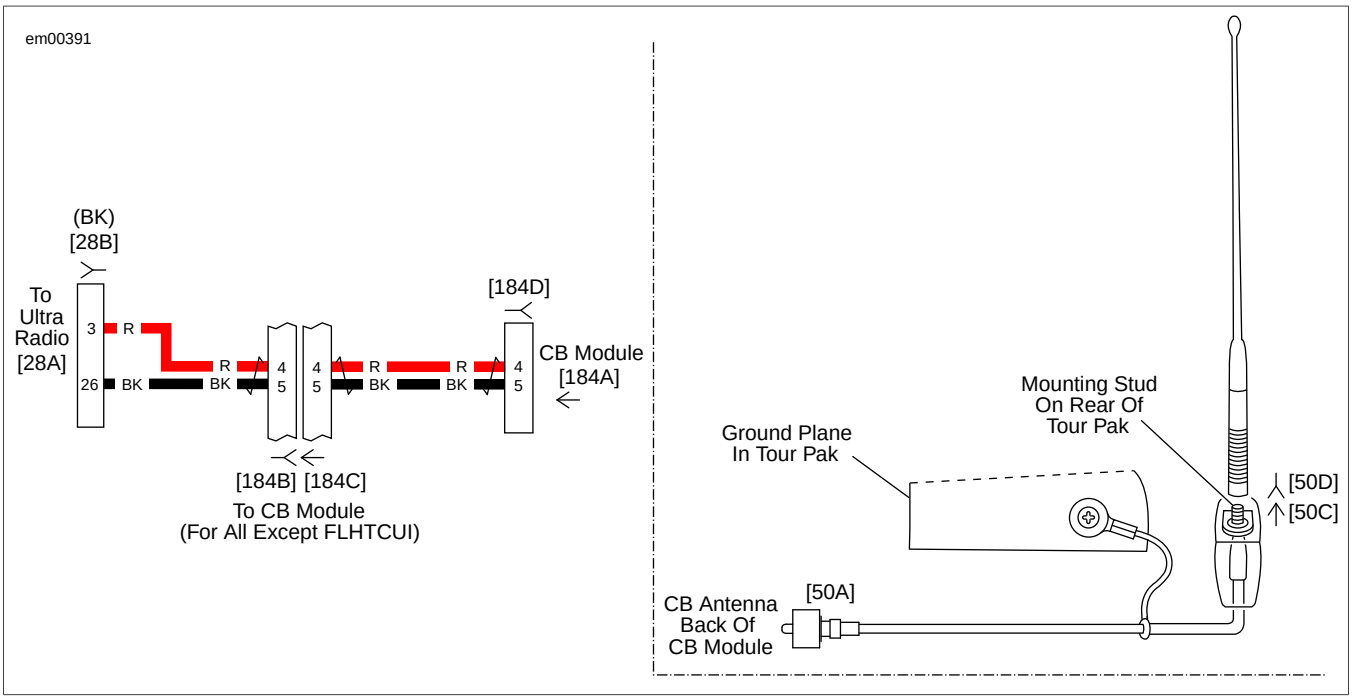
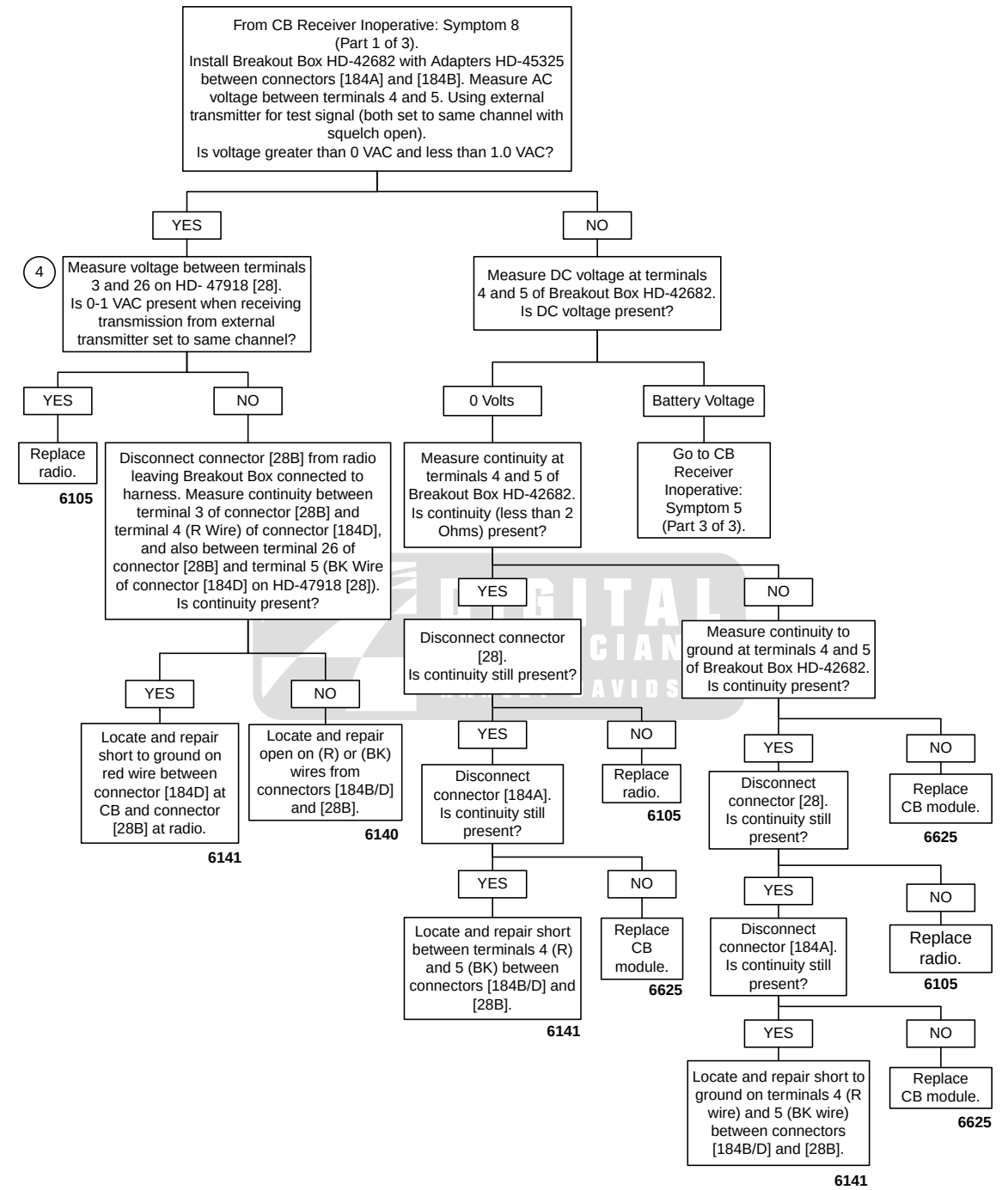


Figure 5-33. CB Receiver Audio Circuit

Table 5-36. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[50]	CB antenna cable	-	Inner fairing - back of CB module
[184]	CB module	12-Place Mini-Deutsch	Inner fairing - left side of radio

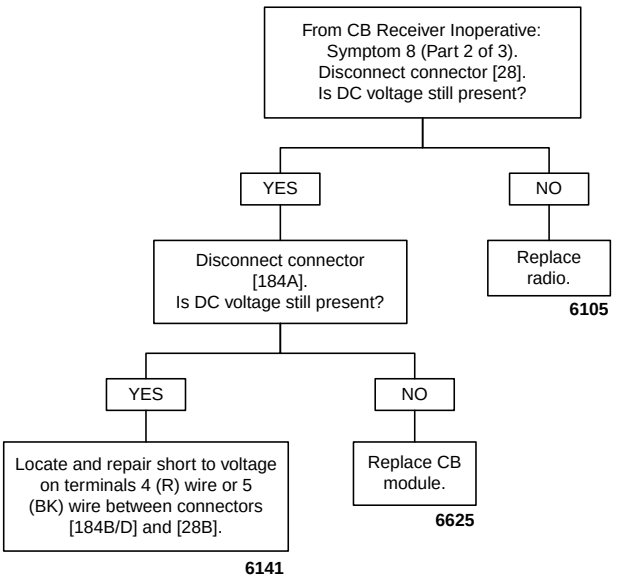
CB Receiver Inoperative: Symptom 5 (Part 2 of 3)



Confirm proper operation with no DTCs.

fc02322_en

CB Receiver Inoperative: Symptom 5 (Part 3 of 3)



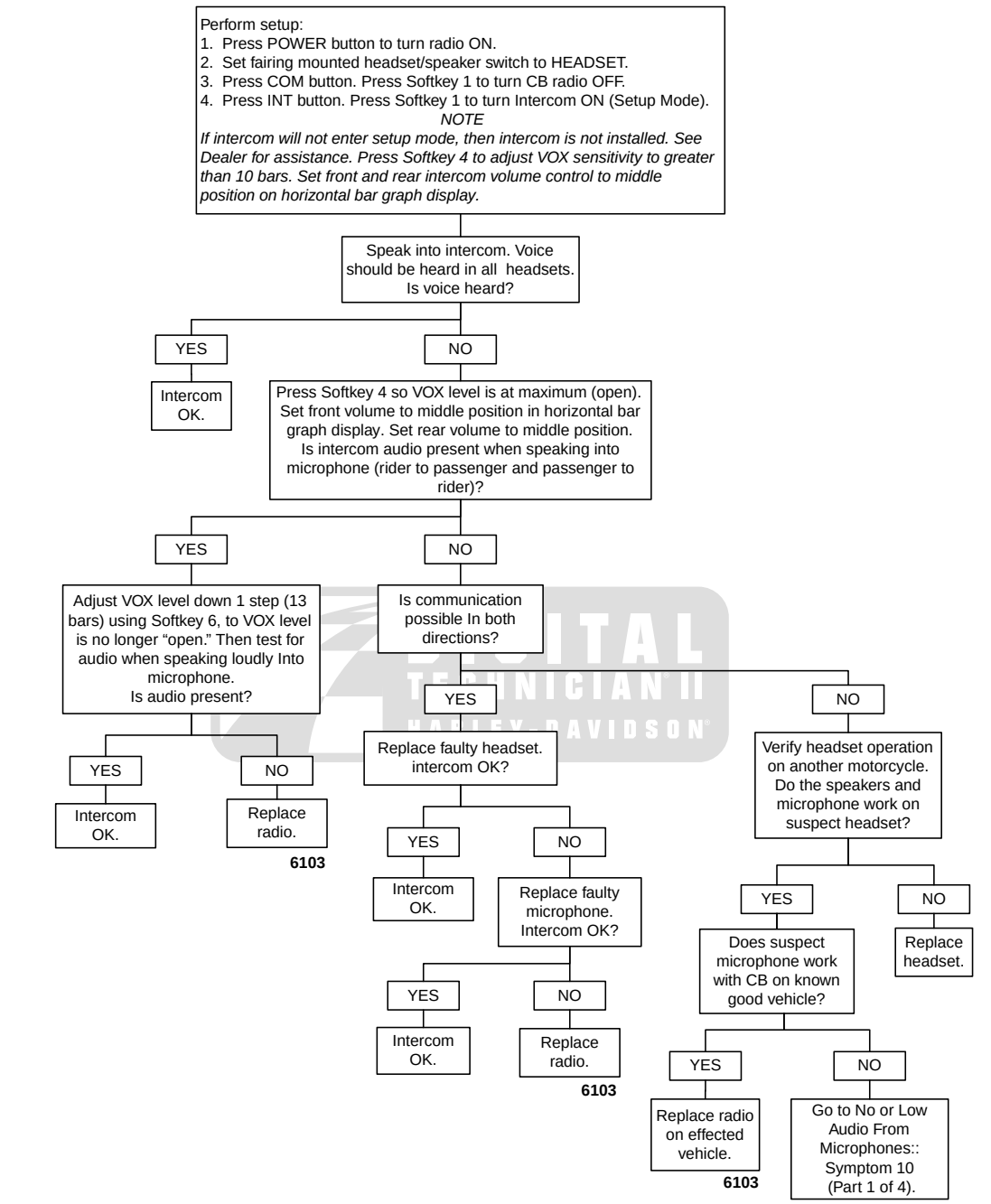


Confirm proper operation with no DTCs.

fc02323_en

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

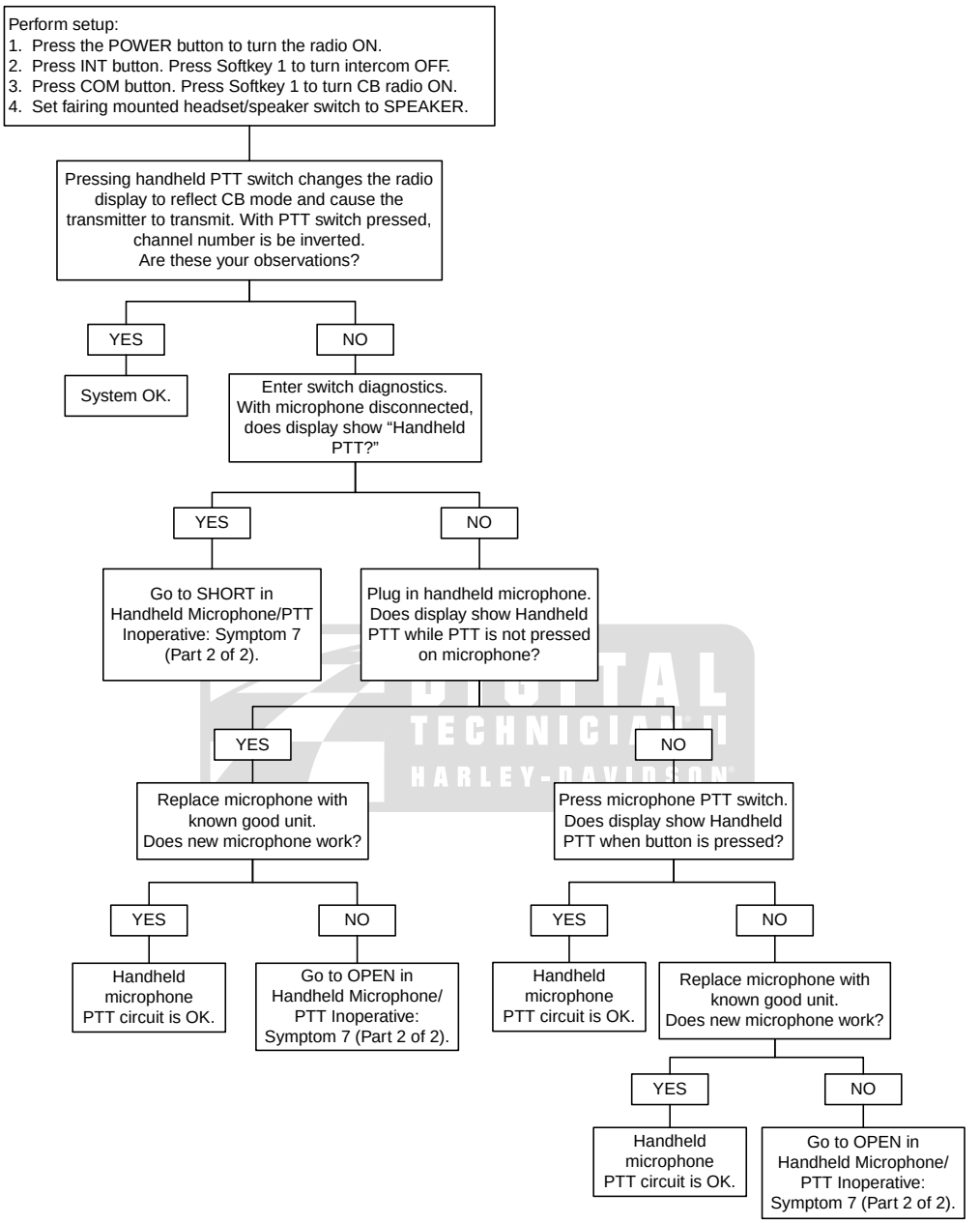
Intercom Inoperative: Symptom 6

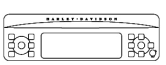


Confirm proper operation with no DTCs.

fc02324_en

Handheld Microphone/PTT Inoperative: Symptom 7 (Part 1 of 2)





Confirm proper operation with no DTCs.

fc02325_en

Handheld Microphone/PTT Inoperative: Symptom 7 (Part 2 of 2)

From Handheld Microphone/PTT Inoperative: Symptom 7 (Part 1 of 2). Use microphone known to be good. Does problem still exists?

- YES → Place in diagnostic mode. What did Handheld Microphone/PTT Inoperative: Symptom 7 (Part 1 of 2) indicate?
- NO → Replace microphone.

OPEN

Connect Breakout Box to harness only. Check for continuity as follows:

FROM		TO	
Connector	Terminal	Connector	Terminal
[27B]	2 (BE/Y)	Front Headset DIN	7
[28B]	17 (Y/BK)	Front Headset DIN	6

Does each wire measure less than 0.5 Ohms?

- YES → Replace radio. **6103**
- NO → Check for continuity as follows:

FROM		TO	
Connector	Terminal	Connector	Terminal
[27B]	2 (BE/Y)	[53B]	6
[28B]	17 (Y/BK)	[53B]	7

Does each wire measure less than 0.5 Ohms?

- YES → Replace pod headset harness. **6616**
- NO (Y/BK) → Locate and repair open on (BE/Y) or (Y/BK) wires. **6142**
- NO (BE/Y) → Check for continuity as follows:

FROM		TO	
Connector	Terminal	Connector	Terminal
[27B]	2 (BE/Y)	[6B]	4 (BE/Y)

Is continuity present?

- YES → Replace pod headset harness. **6616**
- NO → Locate and repair open on (BE/Y) wire in audio harness. **6142**

SHORT

Check for continuity as follows:

FROM		TO
Connector	Terminal	
[27B]	2 (BE/Y)	Ground

Does it measure infinity?

- YES → Replace radio. **6103**
- NO → Disconnect connector [53]. Check for continuity as follows:

FROM		TO
Connector	Terminal	
[27B]	2 (BE/Y)	Ground

Does it measure infinity?

- YES → Replace pod headset harness. **6616**
- NO → Locate and repair short to ground on (BK/Y) wire in audio harness. **6142**

Confirm proper operation with no DTCs.

fc02326_en

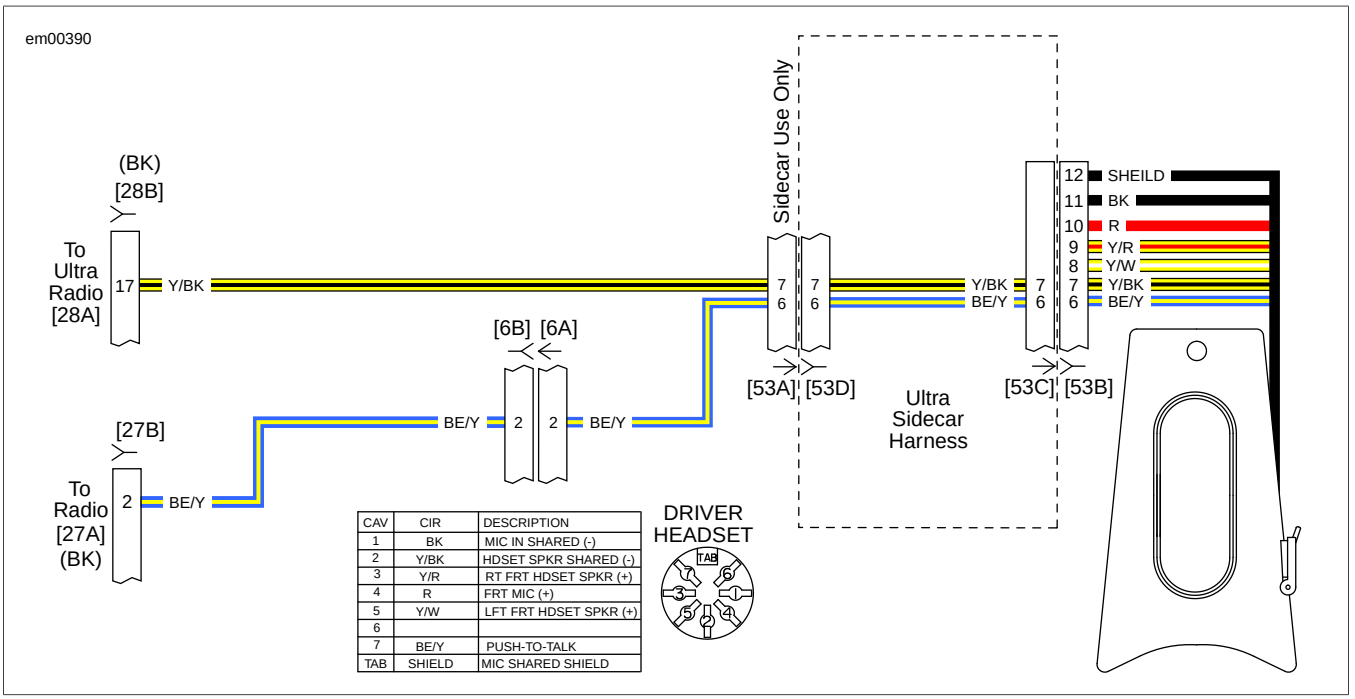
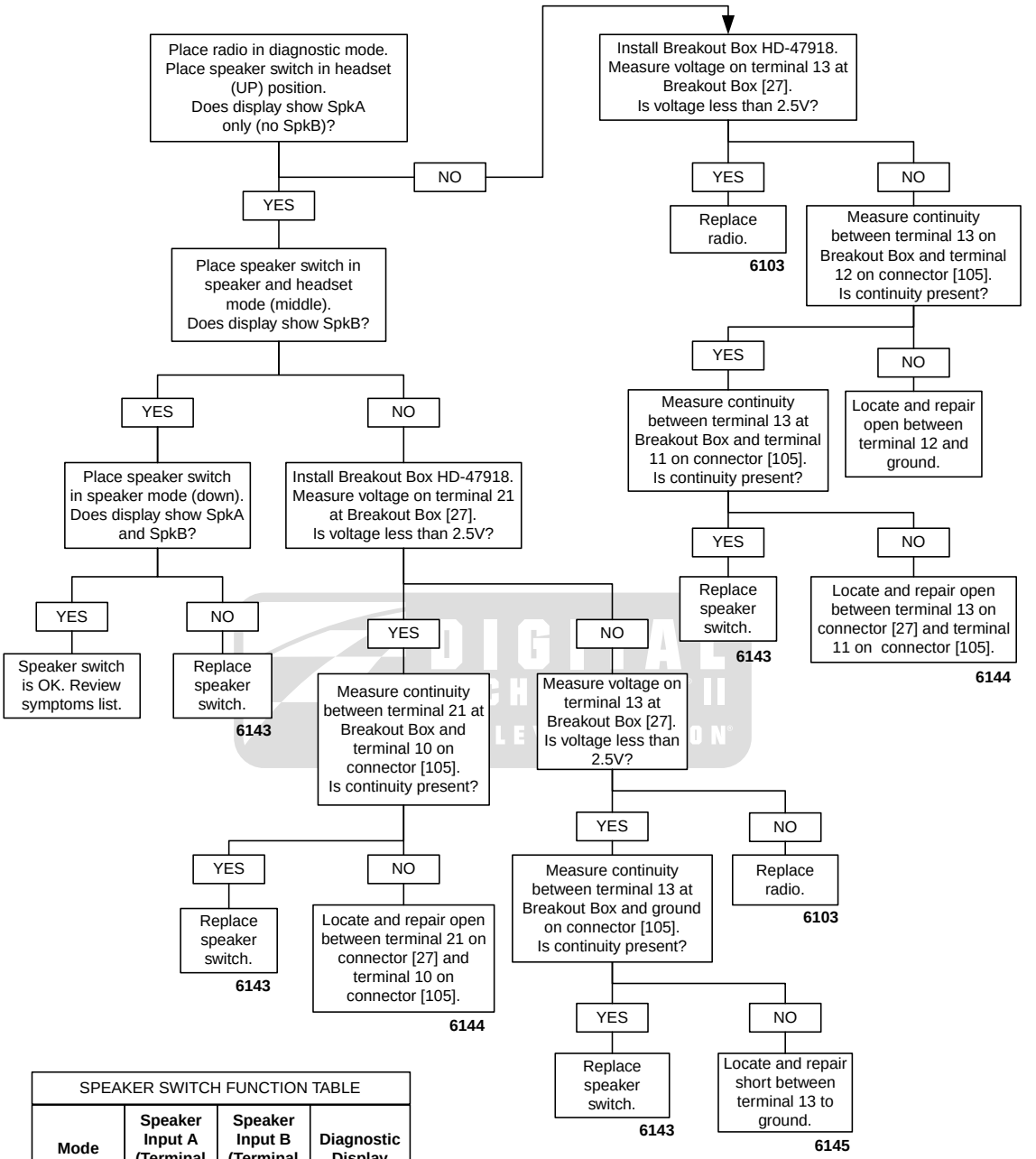


Figure 5-34. Handheld Microphone/PTT Circuit

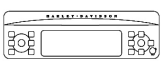
Table 5-37. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect harness	6-Place Deutsch (Black)	Inner fairing - back of radio (left side)
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[53]	Console pod	12-Place Mini-Deutsch	Rear of battery box (under seat)

Speaker Switch Malfunction: Symptom 8



SPEAKER SWITCH FUNCTION TABLE			
Mode	**Speaker Input A (Terminal 21)**	**Speaker Input B (Terminal 13)**	**Diagnostic Display**
Headset	Battery Voltage	0-1 V	SpkA
Speaker/ Headset	0-1 V	4.5-5.5 V	SpkB
Speaker	Battery Voltage	4.5-5.5 V	SpkA SpkB



Confirm proper operation with no DTCs.

fc02327_en

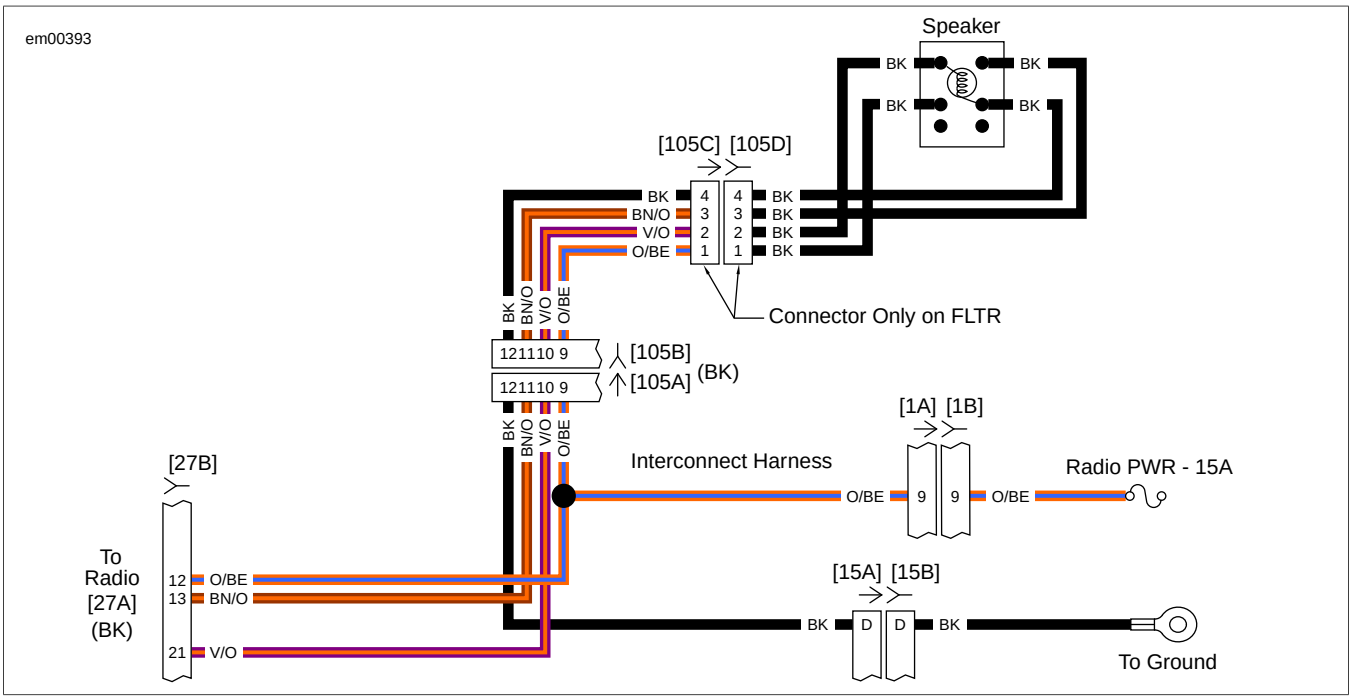
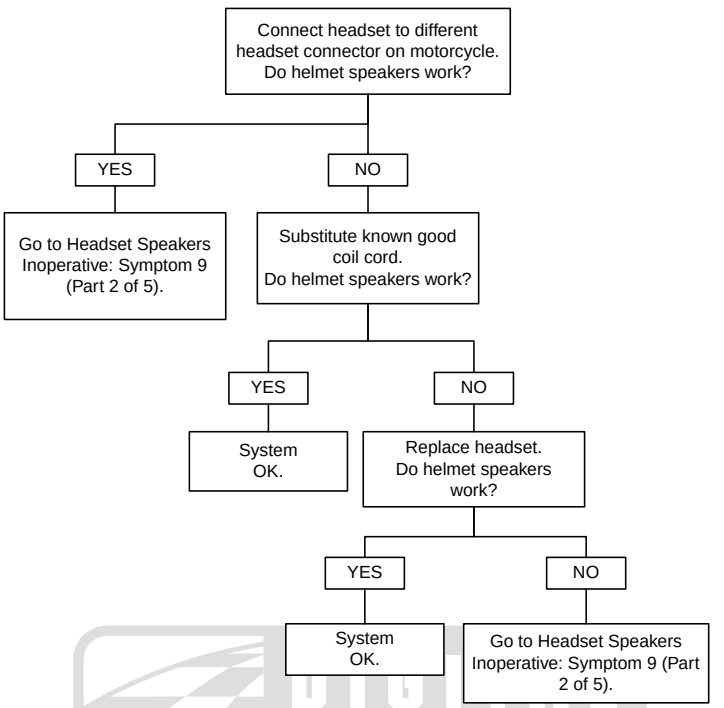


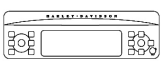
Figure 5-35. Speaker Switch Circuit

Table 5-38. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-Place Molex	Inner fairing - right radio support bracket
[15]	Main to interconnect harness	4-Place Packard	Inner fairing - right fairing bracket
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[105]	Fairing cap switches	12-Place Multilock	Inner fairing - above upper fork bracket (right side)

Headset Speakers Inoperative: Symptom 9 (Part 1 of 5)

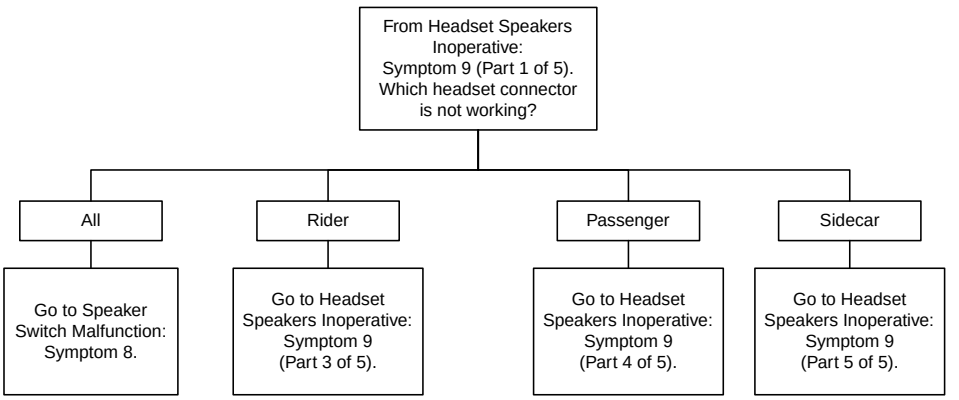




Confirm proper operation with no DTCs.

fc02328_en

Headset Speakers Inoperative: Symptom 9 (Part 2 of 5)



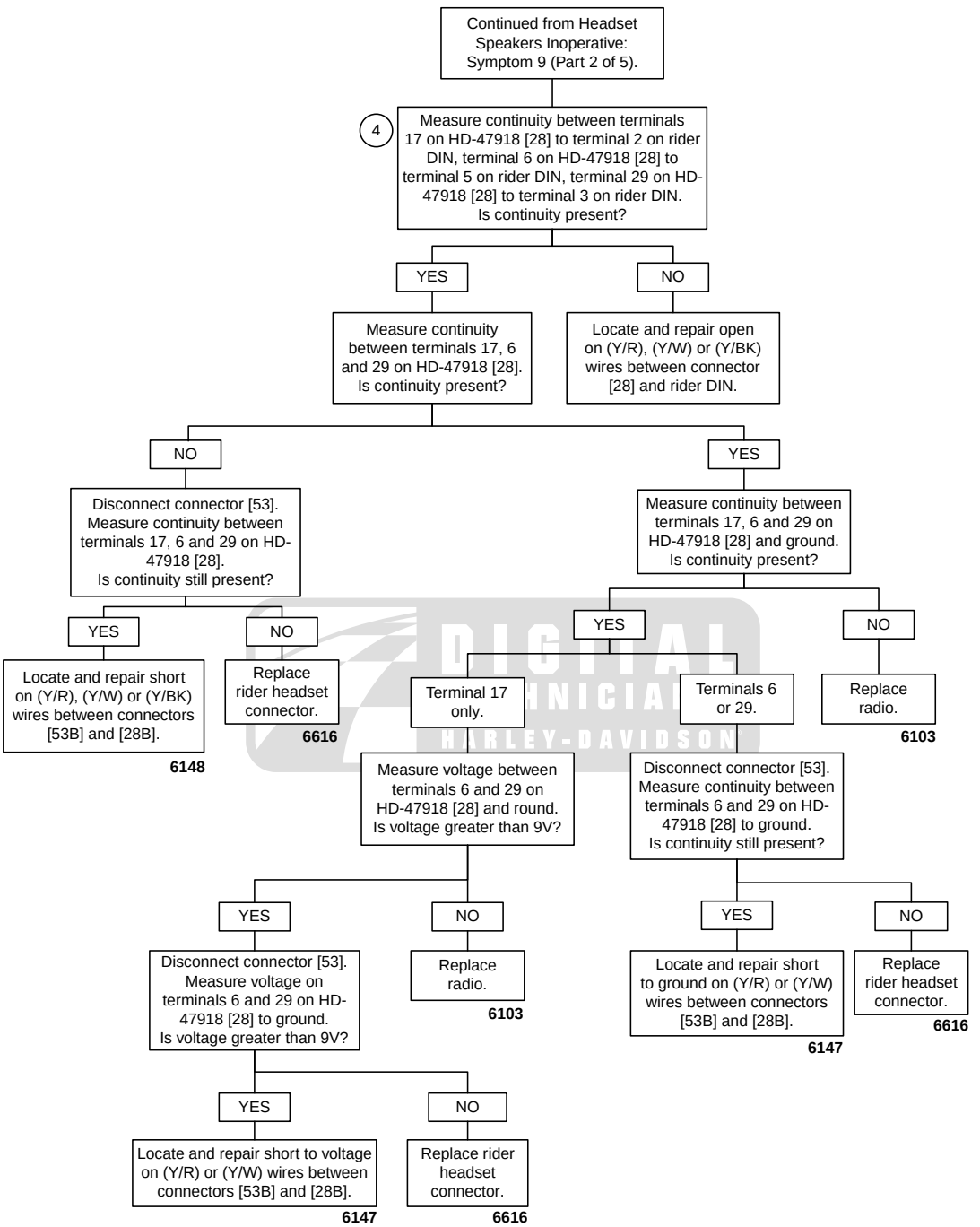


Confirm proper operation with no DTCs.

fc02329_en

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

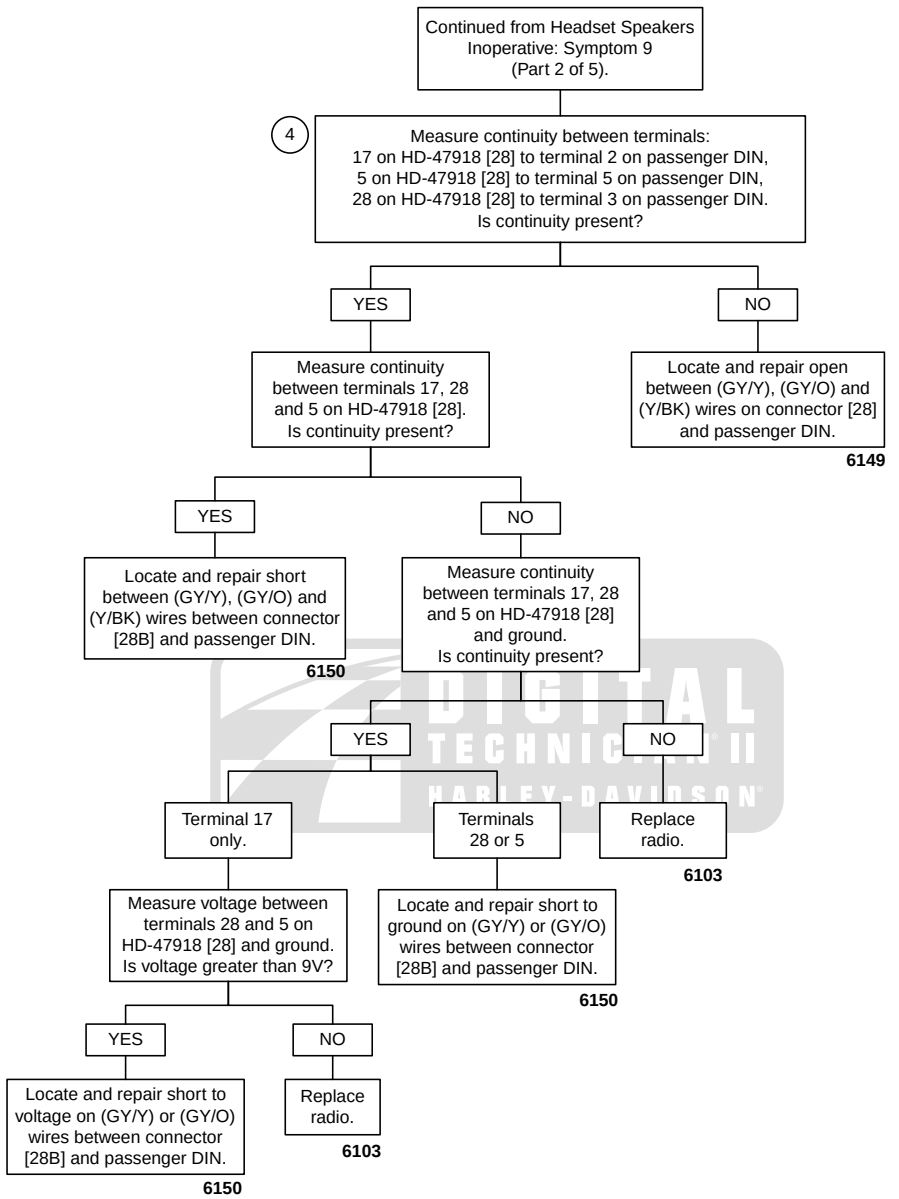
Headset Speakers Inoperative: Symptom 9 (Part 3 of 5)

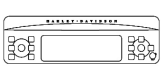


Confirm proper operation with no DTCs.

fc02330_en

Headset Speakers Inoperative: Symptom 9 (Part 4 of 5)

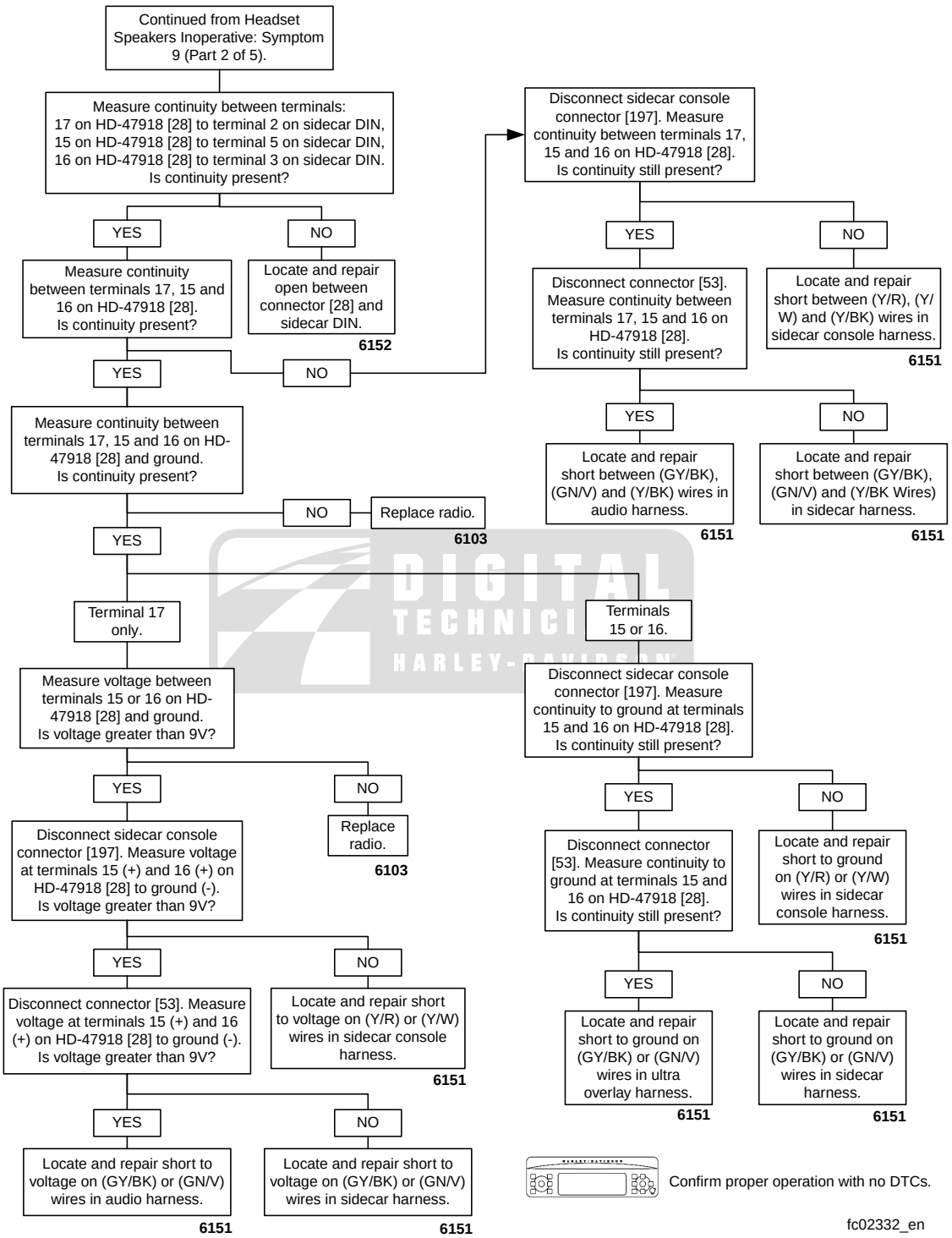




Confirm proper operation with no DTCs.

fc02331_en

Headset Speakers Inoperative: Symptom 9 (Part 5 of 5)



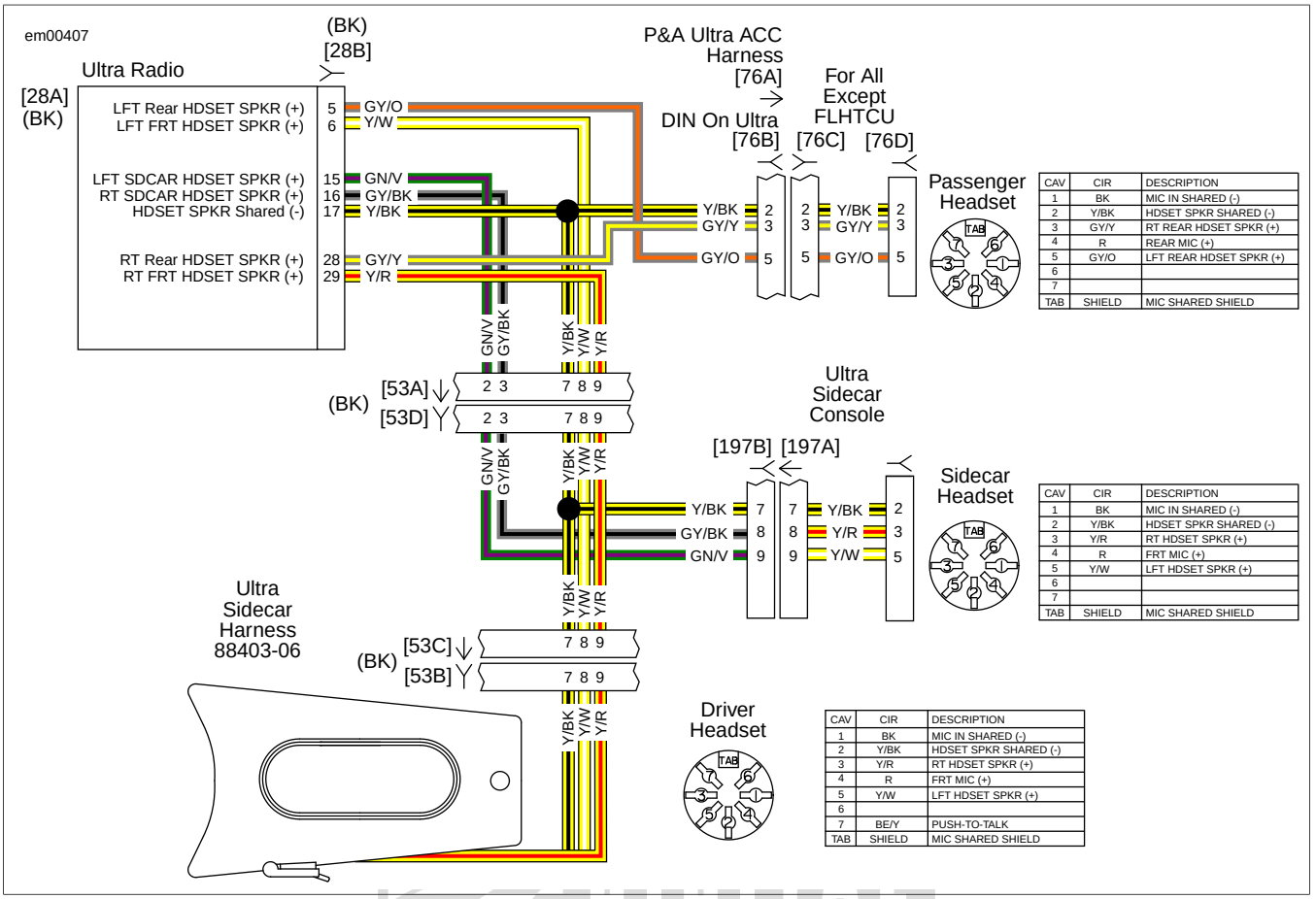
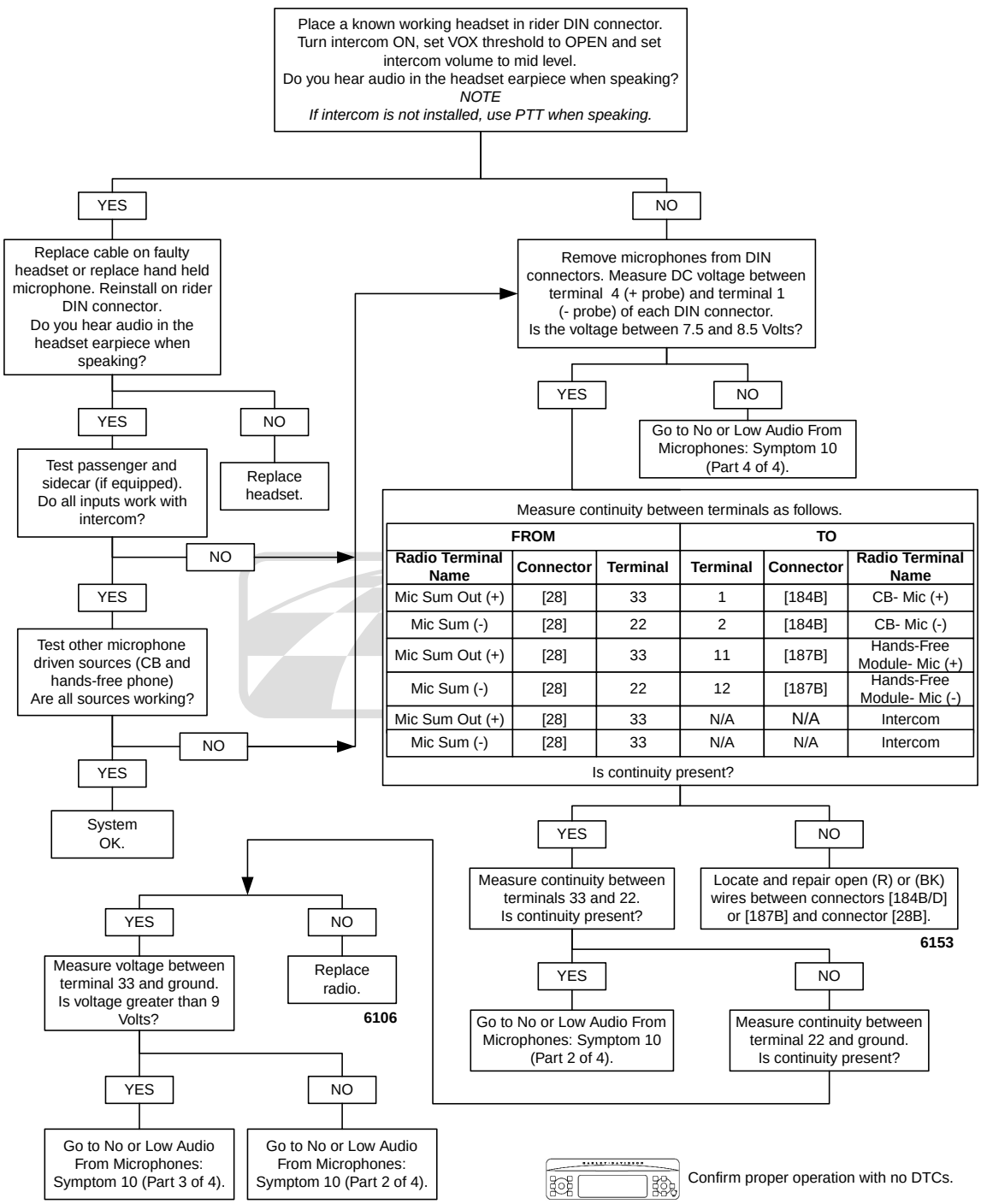


Figure 5-36. Headset Speaker Circuit

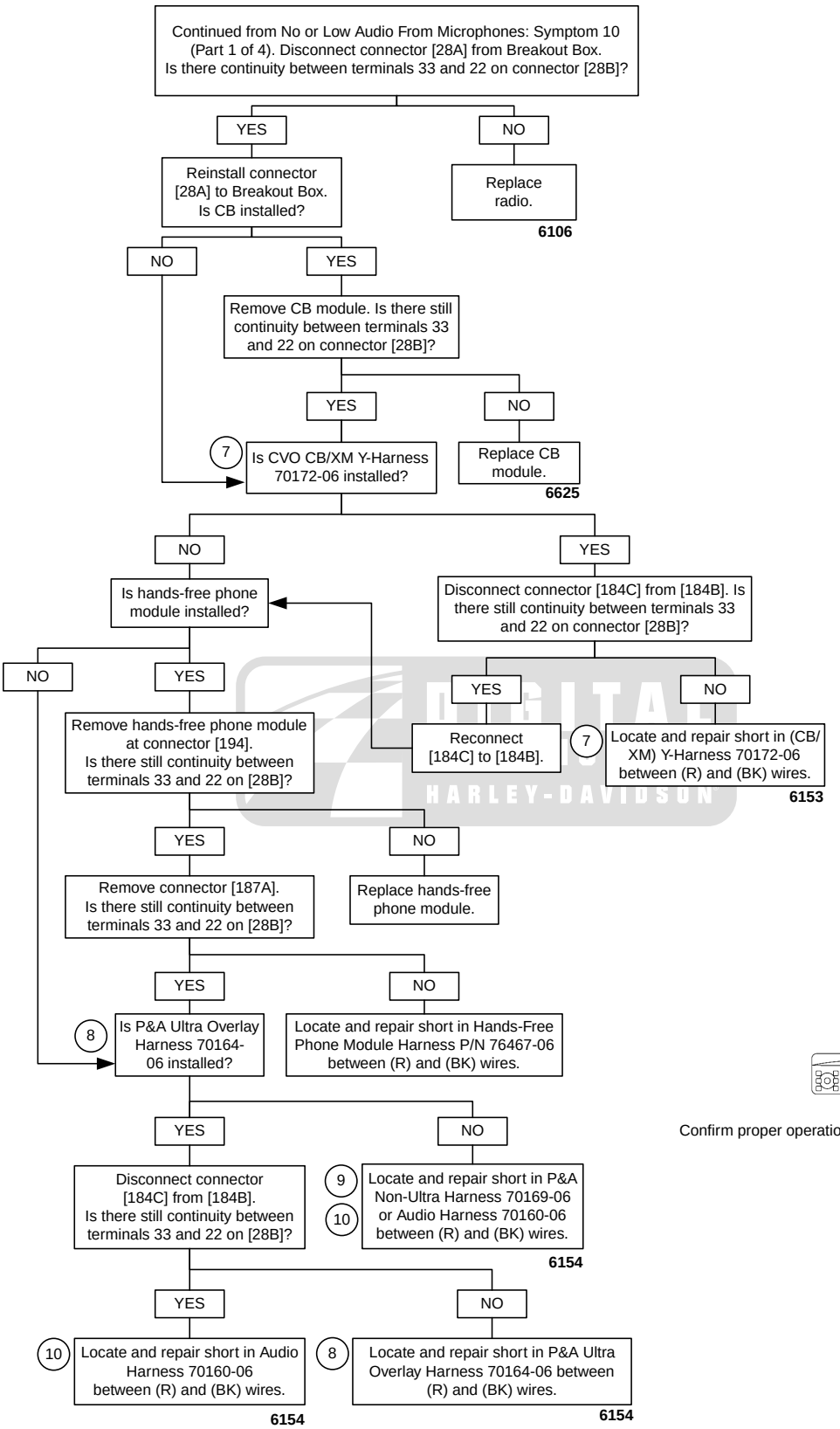
Table 5-39. FLHT/C/U Wire Harness Connectors

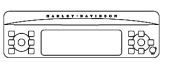
NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[53]	Console pod	12-Place Mini-Deutsch	Rear of battery box (under seat)
[76]	Passenger headset	7-Place DIN	Below left rear speaker box
[197]	Sidecar console	12-Place Mini-Deutsch	Inside sidecar console

No or Low Audio From Microphones: Symptom 10 (Part 1 of 4)



No or Low Audio From Microphones: Symptom 10 (Part 2 of 4)

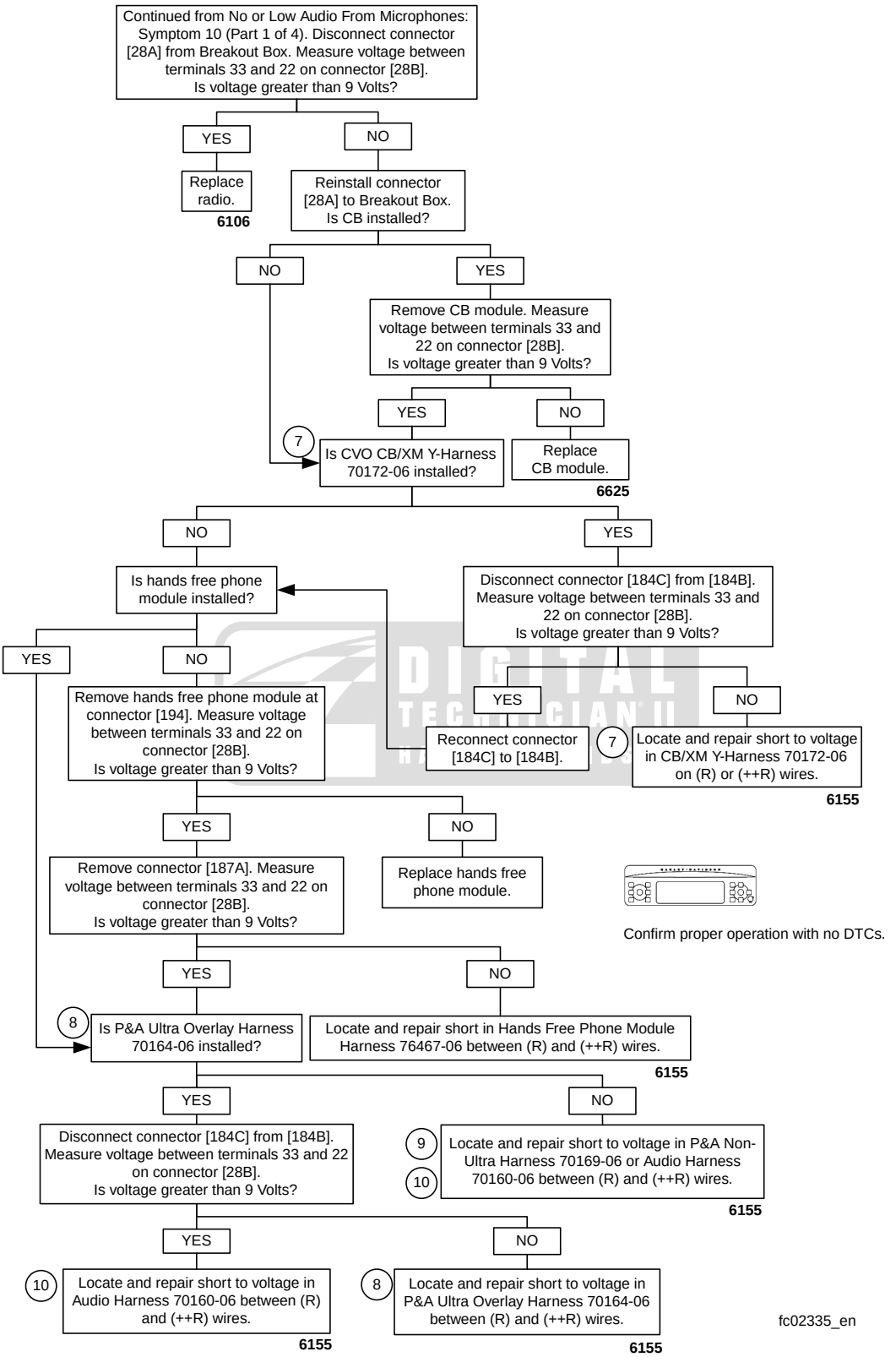




Confirm proper operation with no DTCs.

fc02334_en

No or Low Audio From Microphones: Symptom 10 (Part 3 of 4)



No or Low Audio From Microphones: Symptom 10 (Part 4 of 4)

Continued from No or Low Audio From Microphones: Symptom 10 (Part 1 of 4).

Remove all microphones/headsets. Measure continuity between terminals as follows.

	FROM		FROM	
Function	**Connector**	**Terminal**	**Connector**	**Terminal**
Shield	Rider DIN	Tab	[28B]	21
Mic (+)	Rider DIN	4	[28B]	9
Mic (-)	Rider DIN	1	[28B]	20
Shield	Passenger DIN	Tab	[28B]	21
Mic (+)	Passenger DIN	4	[28B]	10
Mic (-)	Passenger DIN	1	[28B]	20
Shield	Sidecar DIN	Tab	[28B]	21
Mic (+)	Sidecar DIN	4	[28B]	32
Mic (-)	Sidecar DIN	1	[28B]	20

Is continuity present?

YES

Install Breakout Box HD-44608. Measure continuity between terminals 20 (Mic Shared -) and 21 (Mic Shared Shield) on connector [28B] and ground.
Is continuity present?

YES

Measure continuity between terminals 9, 10 and 32 (Mic +) on connector [28B] and ground.
Is continuity present?

YES

Disconnect connector [28B] from Breakout Box. Measure voltage at terminals 9, 10 and 32.
Is voltage between 7.5 and 8.5 Volts?

YES

Reconnect connector [28B] to Breakout Box. Measure voltage at terminals 9, 10 and 32.
Is voltage greater than 8.5 Volts?

YES

Locate and repair short to battery on (R) wire showing short to voltage.

6155

NO

Were you directed to these charts from NO OR LOW AUDIO TO HANDS FREE MODULE?

YES

Replace hands free phone module.

NO

No trouble found.

NO

Replace radio.

6106

NO

Locate and repair short to ground on (R) wire showing continuity.

6155

NO

Replace radio.

6106

NO

Locate and repair open on (R), (BK) and shield wires between DIN connector and connector [28B].

6153



Confirm proper operation with no DTCs.

fc02336_en

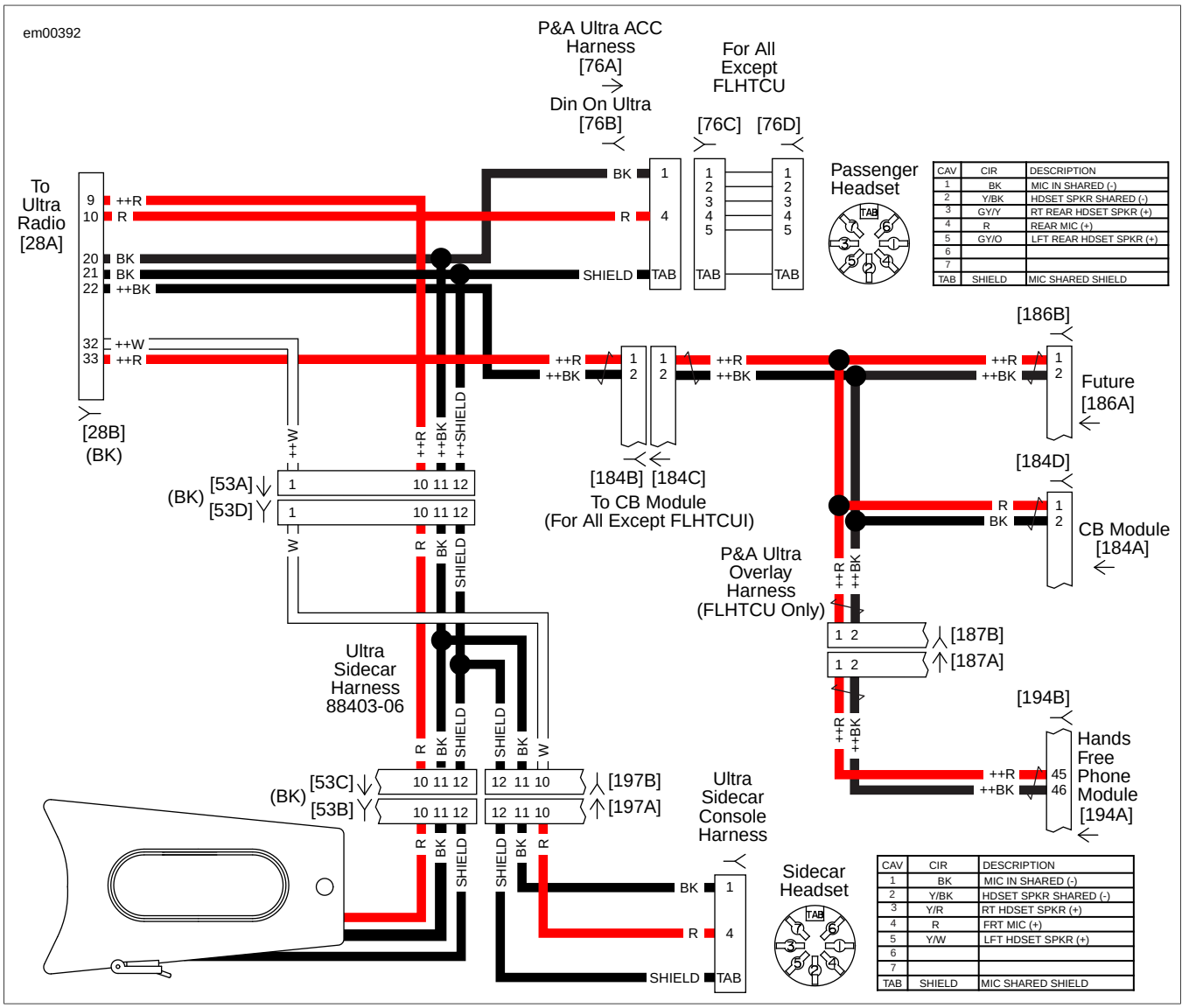
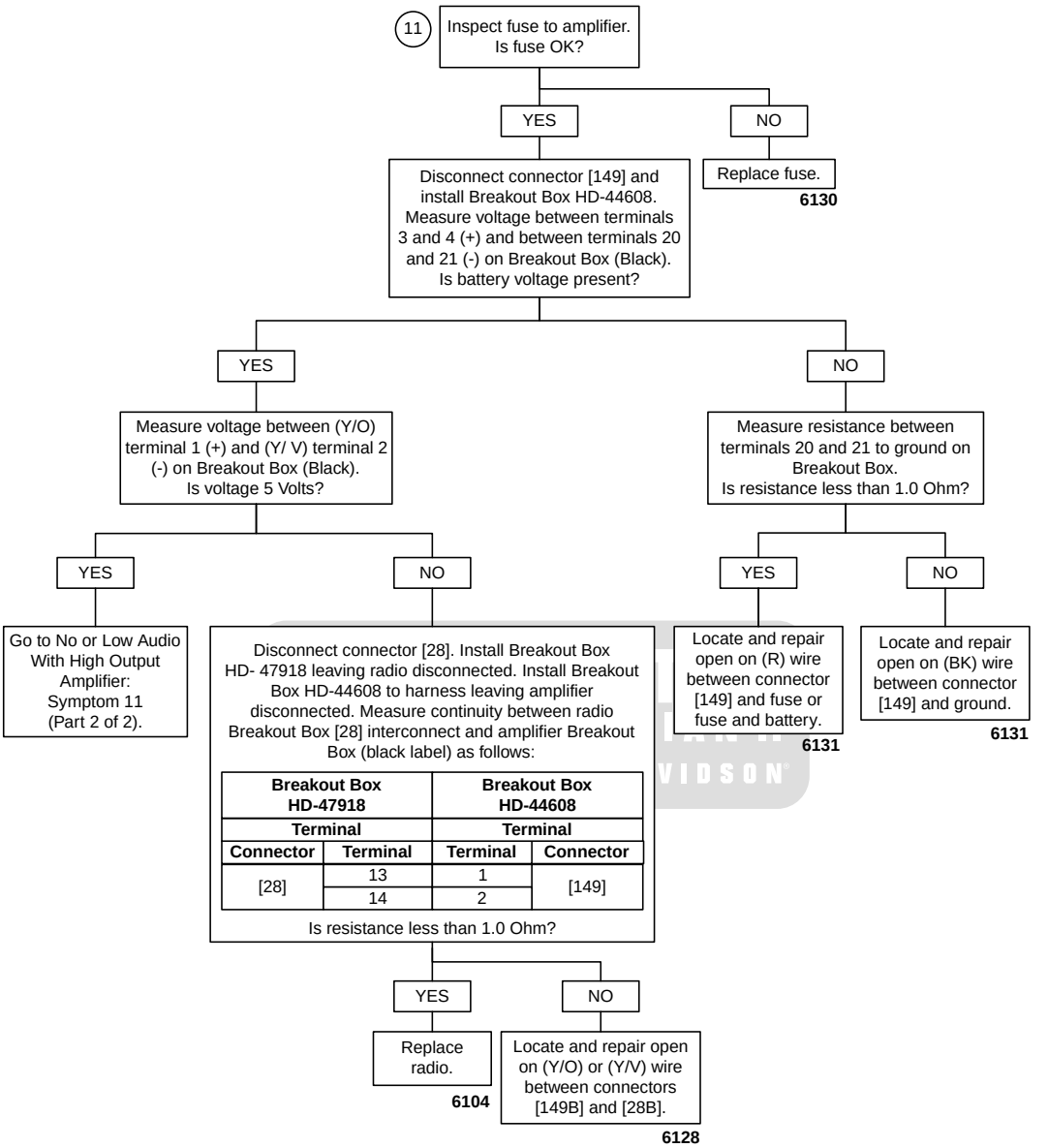


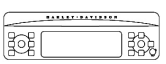
Figure 5-37. Microphone Audio Input Circuit

Table 5-40. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[27]	Radio	23-place Amp	Inner fairing - back of radio (right side)
[28]	Radio	35-place Amp	Inner fairing - back of radio (left side)
[53]	Console pod	12-place Deutsch	Rear of battery box under seat
[76]	Passenger headset	7-place DIN	Below left rear speaker box
[184]	CB module	12-place Deutsch	Inner fairing; left side of radio
[186]	Future	12-place Deutsch	Inside fairing
[187]	Hands-free phone module	12-place Deutsch	Inner fairing, top of left side
[194]	Hands-free phone module	54-place Amp	Inside TourPak left side
[197]	Sidecar console	12-place Deutsch	Inside sidecar console

No or Low Audio with High Output Amplifier: Symptom 11 (Part 1 of 2)





Confirm proper operation with no DTCs.

fc02337_en

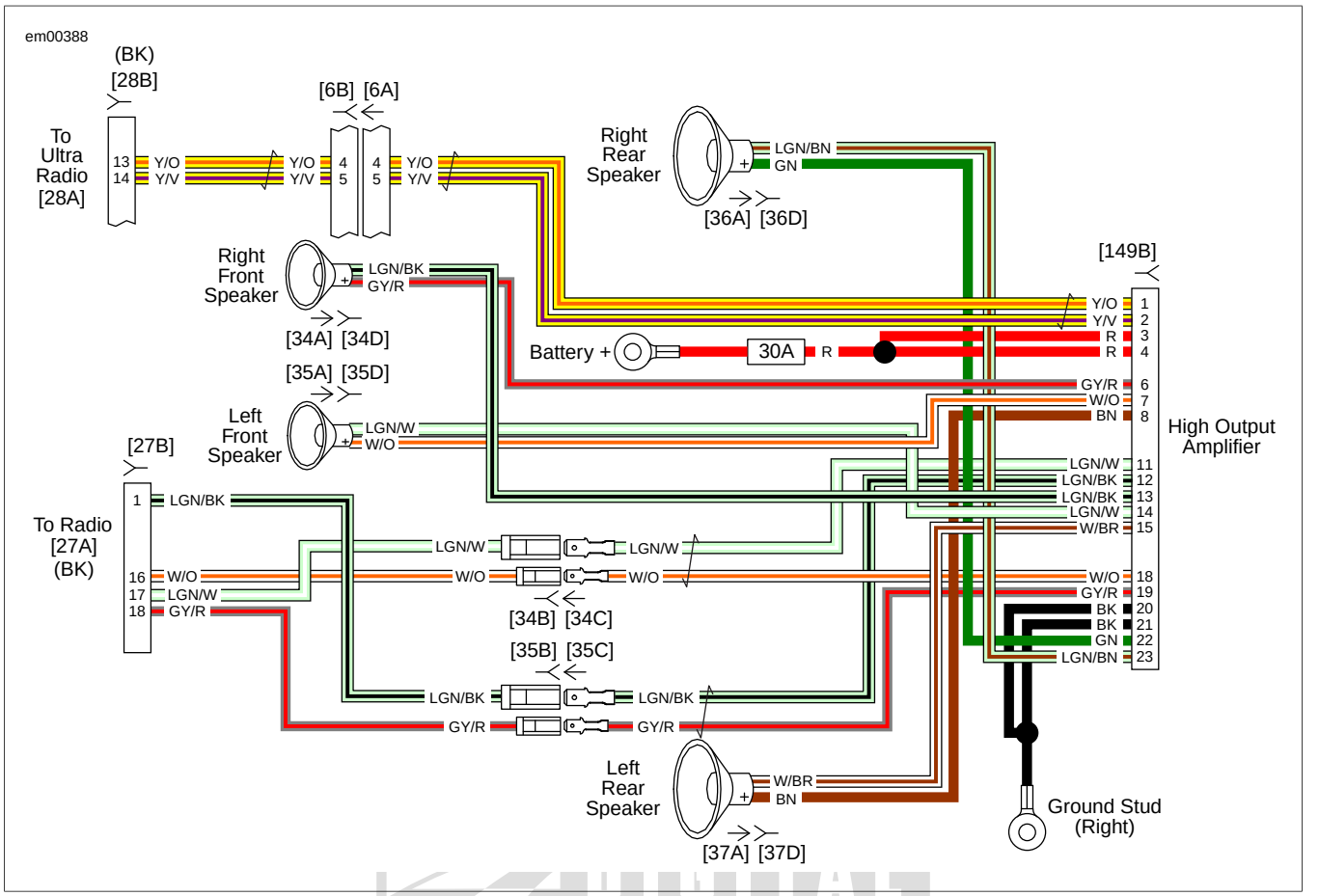
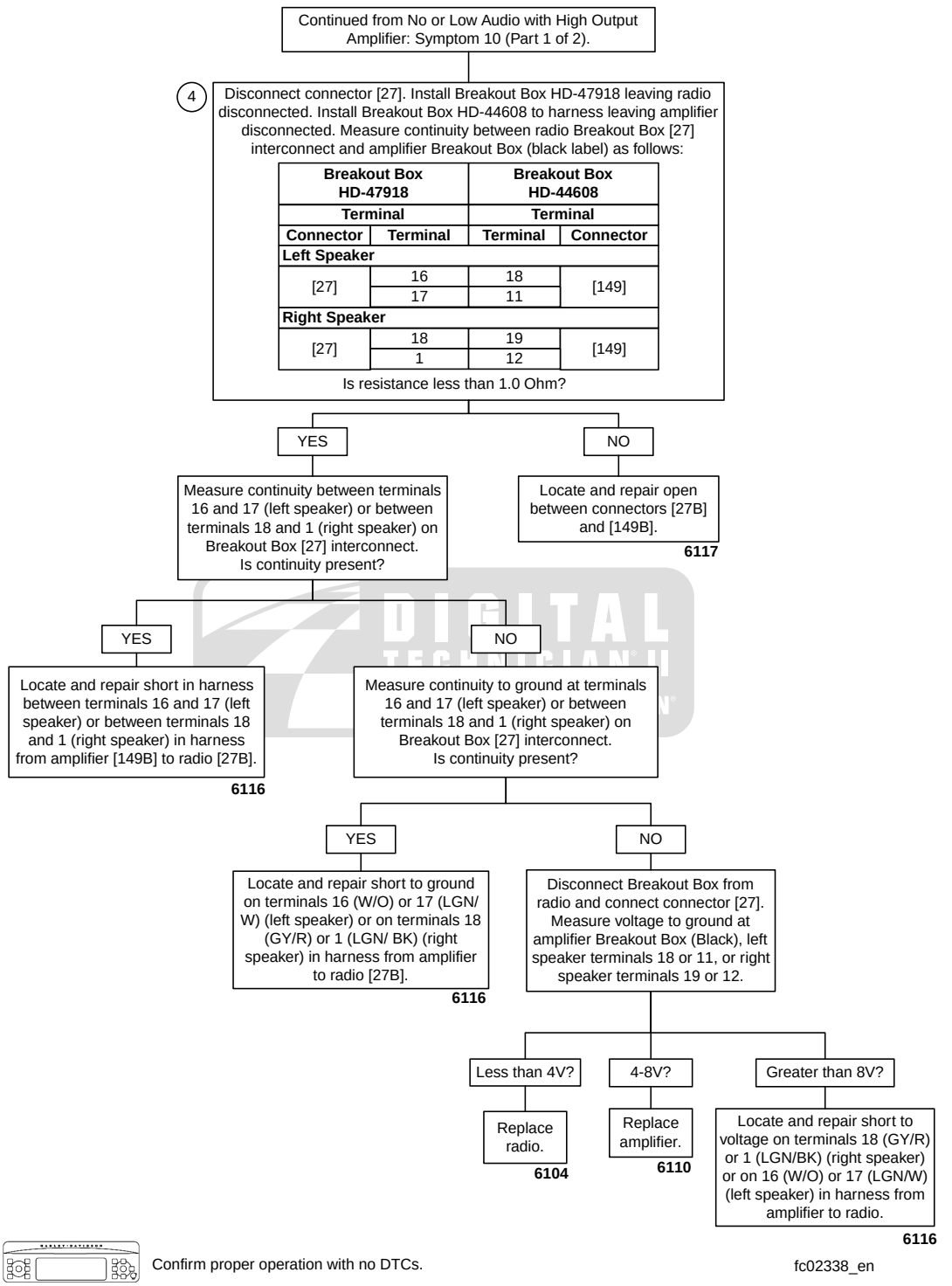


Figure 5-38. Front/Rear Speaker Circuits with Amplifier

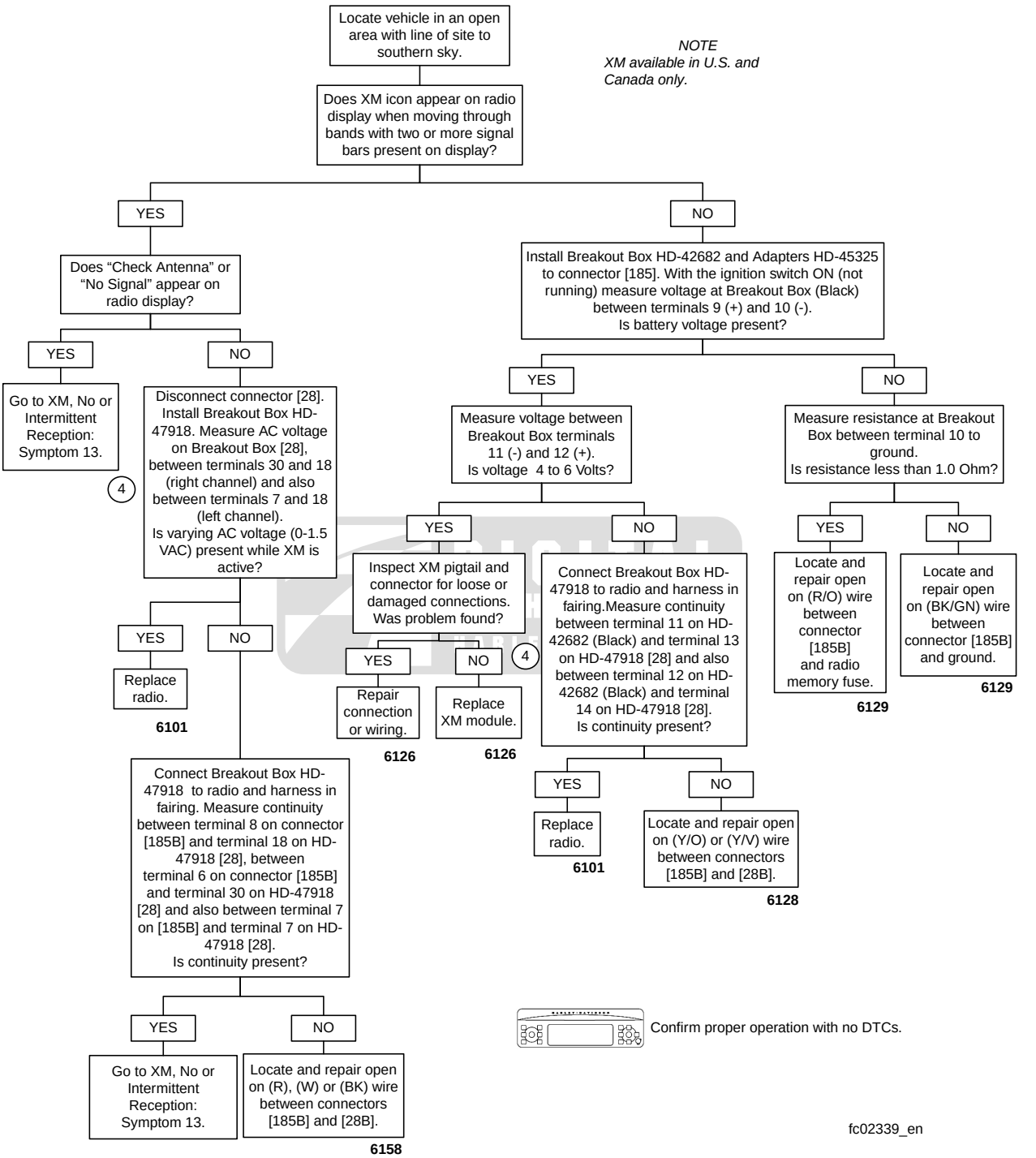
Table 5-41. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect harness	6-Place Deutsch (Black)	Inner fairing - left side of radio
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[34]	Front right speaker	Spade contacts	Inner fairing - back of right speaker
[35]	Front left speaker	Spade contacts	Inner fairing - back of left speaker
[36]	Rear right speaker	Spade contacts	Inside speaker box
[37]	Rear left speaker	Spade contacts	Inside speaker box
[149]	High output amplifier	23-Place Amp	Under luggage rack (right side)

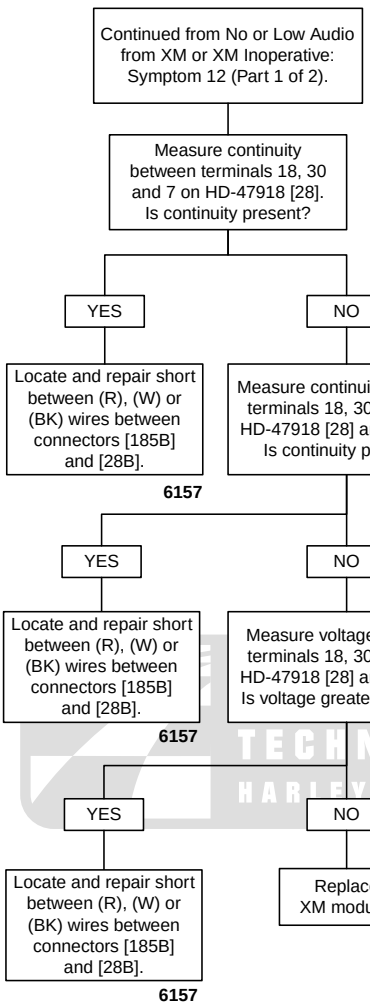
No or Low Audio with High Output Amplifier: Symptom 11 (Part 2 of 2)



No or Low Audio from XM or XM Inoperative: Symptom 12 (Part 1 of 2)



No or Low Audio from XM or XM Inoperative: Symptom 12 (Part 2 of 2)



Confirm proper operation with no DTCs.

fc02340_en

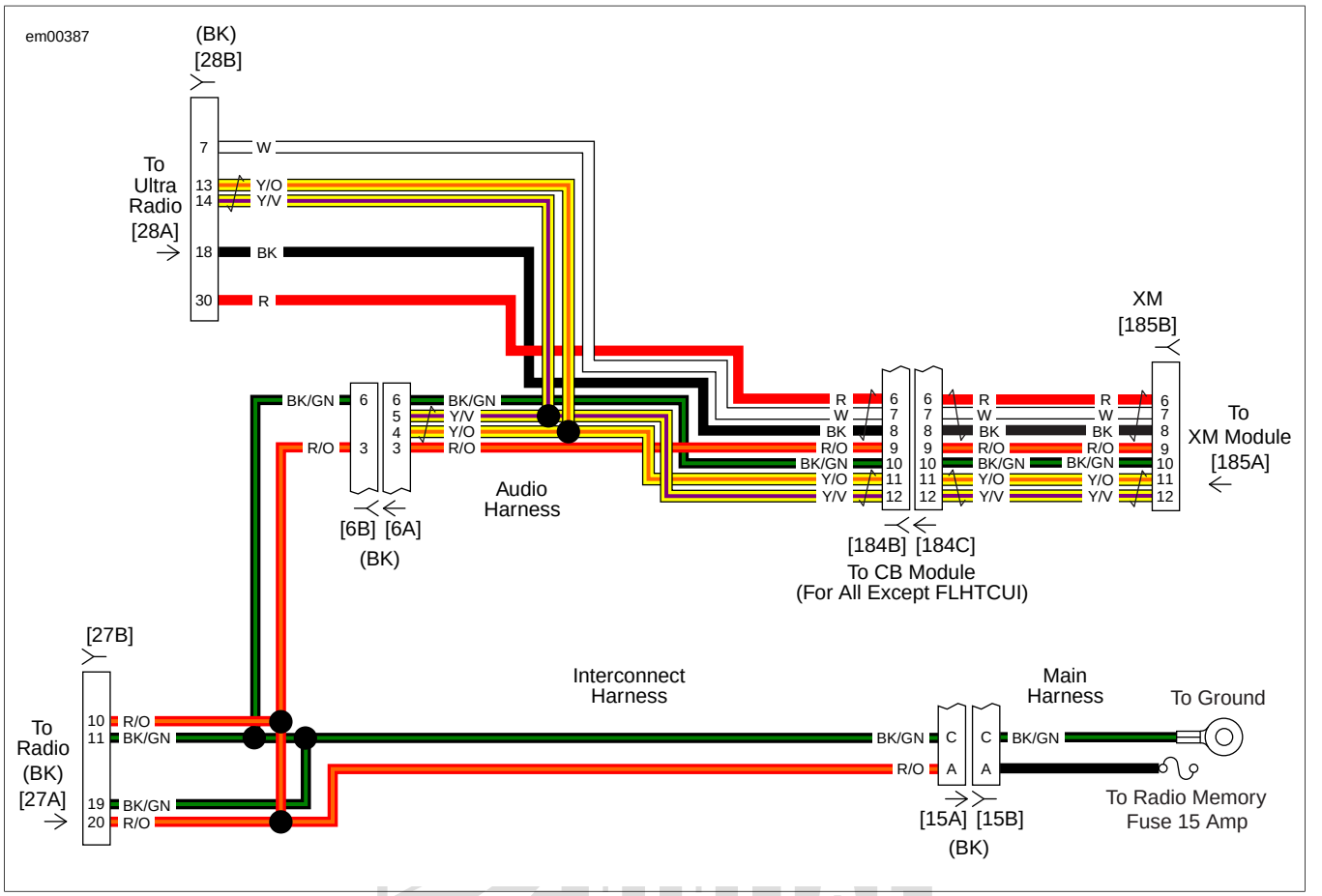
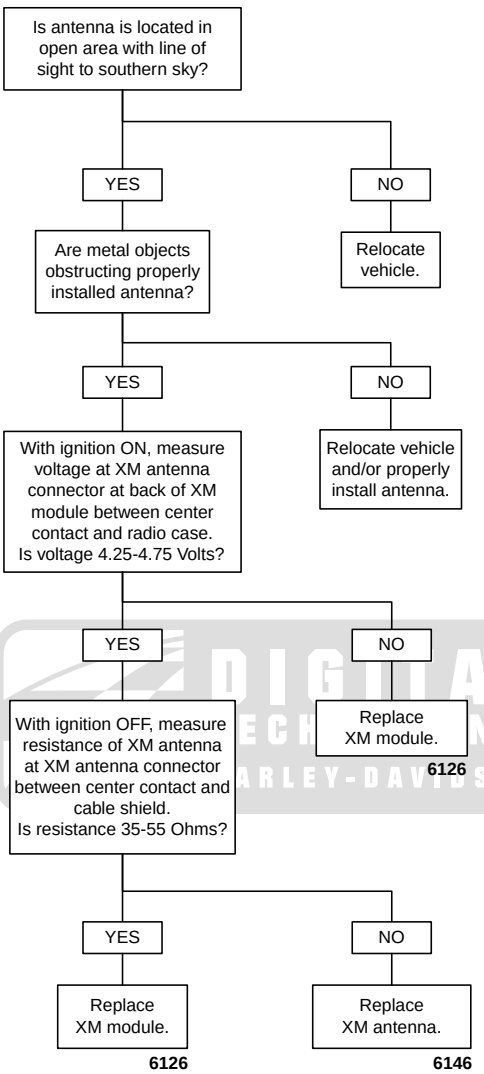


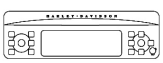
Figure 5-39. XM Circuit

Table 5-42. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect harness	6-Place Deutsch (Black)	Inner fairing - left side of radio
[15]	Main to interconnect harness	4-Place Packard	Inner fairing - right fairing bracket
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[184]	CB Module	12-Place Mini-Deutsch	Inner fairing - left side of radio
[185]	XM Module	12-Place Mini-Deutsch	Inner fairing - top of radio (left side)

XM - No or Intermittent Reception: Symptom 13

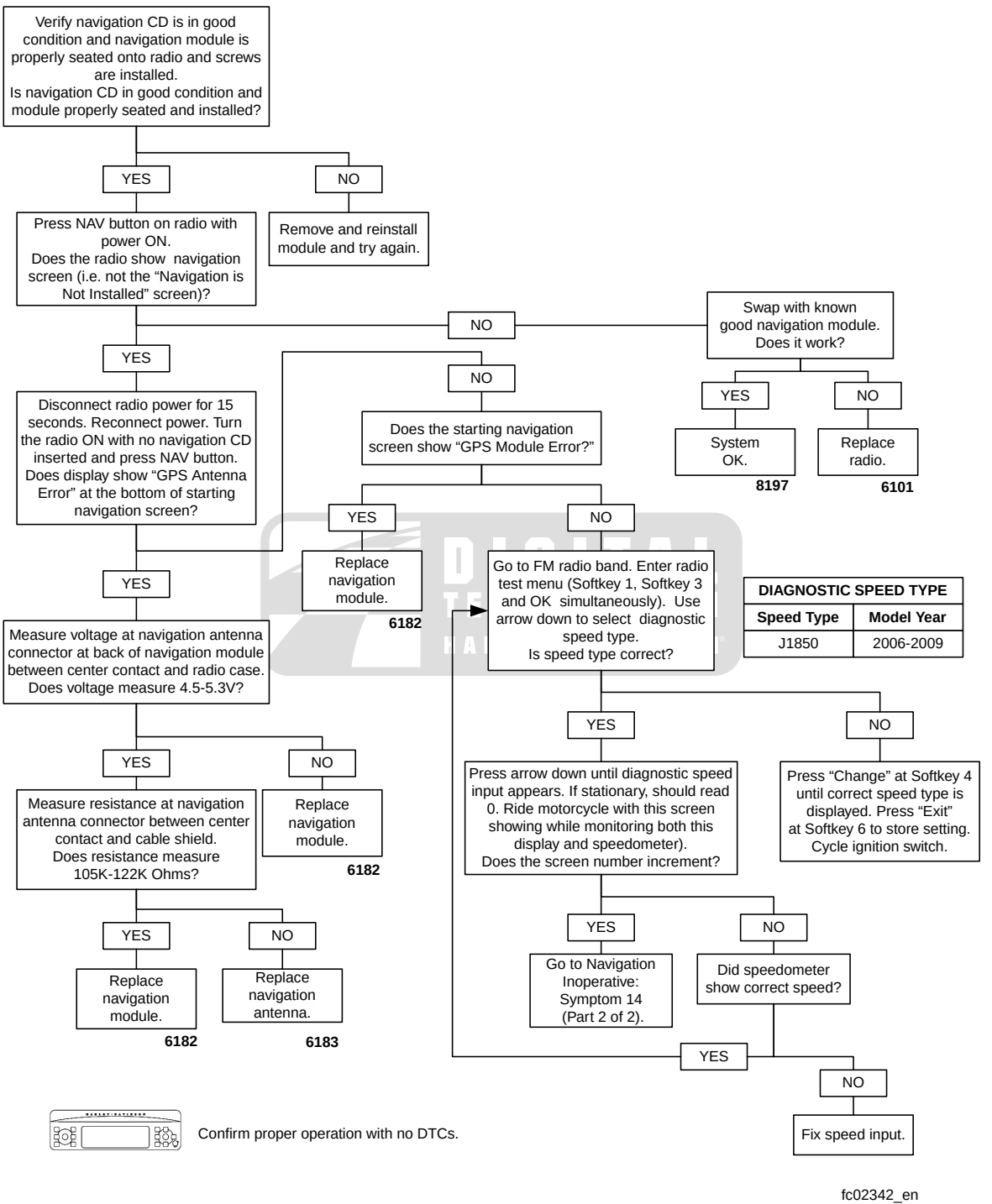




Confirm proper operation with no DTCs.

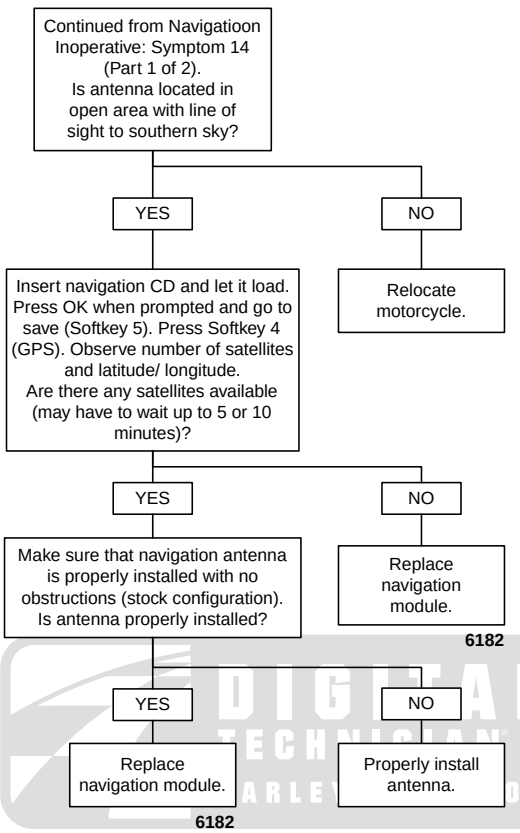
fc02341_en

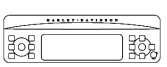
Navigation Inoperative: Symptom 14 (Part 1 of 2)



fc02342_en

Navigation Inoperative: Symptom 14 (Part 2 of 2)

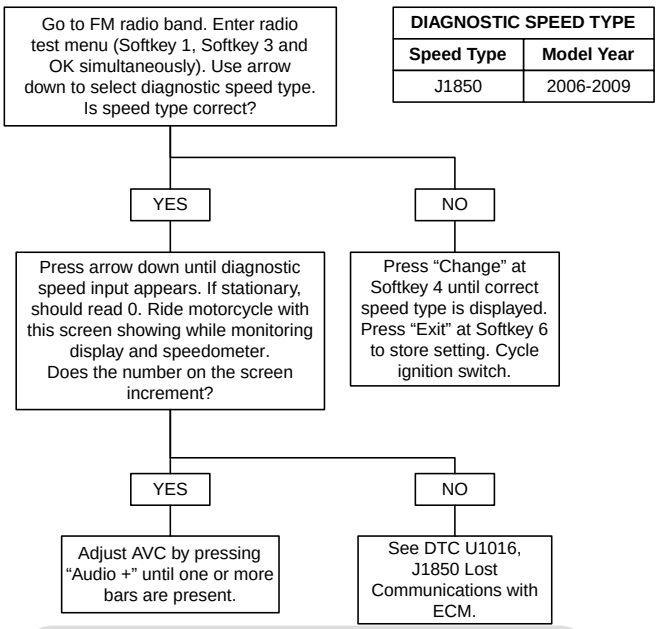




Confirm proper operation with no DTCs.

fc02343_en

AVC Inoperative: Symptom 15



DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Handlebar, Passenger or Sidecar Switches Inoperative: Symptom 16 (Part 1 of 4)

While pressing any two softkeys (presets), turn ignition switch ON to enter diagnostic mode. Will radio enter diagnostic mode?

YES

Is DTC present?

YES

See DIAGNOSIS for applicable DTC:

DTC	DESCRIPTION	GO TO
B2006	Radio Switches Stuck or Open	
	Replace Radio.	
B2007	Handlebar Switches Shorted High	
	Audio	DTC B2007, Handlebar Audio Switch Shorted High (Part 1 of 3)
	Mode	DTC B2007, Handlebar Mode Switch Shorted High (Part 2 of 3)
	PTT/Squelch	DTC B2007, Handlebar PPT/Squelch Switch Shorted High (Part 3 of 3)
B2008	Handlebar Switches Shorted Low	
	Audio	DTC B2008, Handlebar Audio Switch Shorted Low (Part 1 of 3)
	Mode	DTC B2008, Handlebar Mode Switch Shorted Low (Part 2 of 3)
	PTT/Squelch	DTC B2008, Handlebar PPT/Squelch Switch Shorted Low (Part 3 of 3)
B2009	Handlebar Switches Stuck or Open	
	Audio	DTC B2009, Handlebar Audio Switch Stuck or Open (Part 1 of 3)
	Mode	DTC B2009, Handlebar Mode Switch Stuck or Open (Part 2 of 3)
	PTT/Squelch	DTC B2009, Handlebar PPT/Squelch Switch Stuck or Open (Part 3 of 3)
B2010	Passenger Switches Shorted High	
	Audio/PTT	DTC B2010, Passenger Audio/PPT Switch Shorted High (Part 1 of 2)
	Mode	DTC B2010, Passenger Mode Switch Shorted High (Part 2 of 2)
B2011	Passenger Switches Shorted Low	
	Audio/PTT	DTC B2011, Passenger Audio/PTT Switch Shorted Low (Part 1 of 2)
	Mode	DTC B2011, Passenger Mode Switch Shorted Low (Part 2 of 2)
B2012	Passenger Switches Stuck or Open	
	Audio/PTT	DTC B2012, Passenger Audio/PTT Switch Stuck or Open (Part 1 of 2)
	Mode	DTC B2012, Passenger Mode Switch Stuck or Open (Part 2 of 2)
B2013	Sidecar Switches Shorted High	
	PTT/Mode	DTC B2013, Sidecar PPT/Mode Switches Shorted High
B2014	Sidecar Switches Shorted Low	
	PTT/Mode	DTC B2014, Sidecar PPT/Mode Switches Shorted Low
B2015	Sidecar Switches Stuck or Open	
	PTT/Mode	DTC B2015, Sidecar PPT/Mode Switches Stuck or Open

NO

Replace radio.

6101

NO

Press applicable switch to verify handlebar, passenger and sidecar switch functionality:
Audio Up
Audio DN
Audio
Mode Up
Mode DN
Mode
PTT
Squelch +
Squelch -
Does display will show each function when pressed?

YES

No current fault found. Repeat function verification while wiggling harness.

NO

Which switches are inoperative?

If equipped with a sidecar, disconnect connector [197B] and perform functionality test. If problem is no longer present proceed to Sidecar Switch.
If problem is still present disconnect connector [28B] from rear of radio and perform functionality test again. If problem does not appear proceed to Passenger Switches. If problem is still present proceed to Handlebar Switches.

Handlebar switches

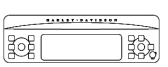
Go to Handlebar Switches Inoperative: Symptom 16 (Part 3 of 4).

Passenger switches

Go to Passenger Switches Inoperative: Symptom 16 (Part 2 of 4).

Sidecar switches

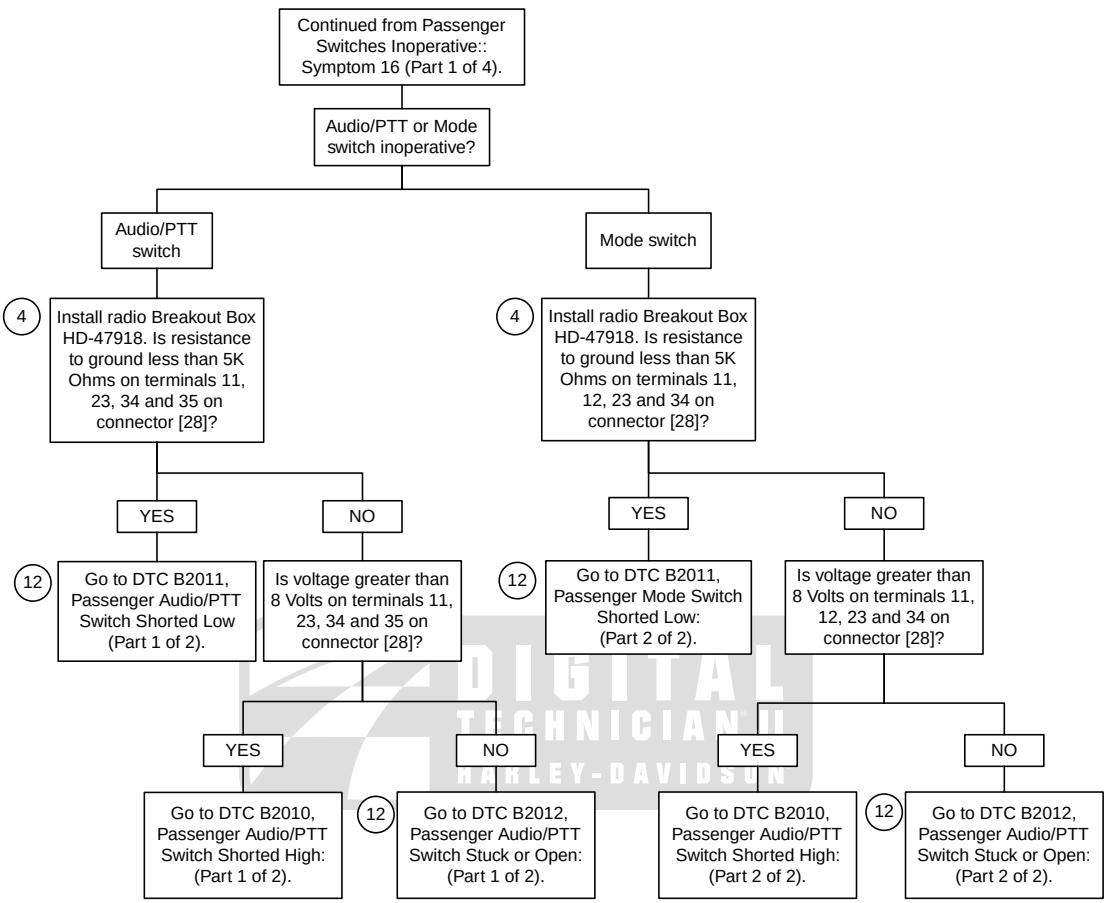
Go to Sidecar Switches Inoperative: Symptom 16 (Part 4 of 4).



Confirm proper operation with no DTCs.

fc02345_en

Handlebar, Passenger or Sidecar Switches Inoperative: Symptom 16 (Part 2 of 4)





Confirm proper operation with no DTCs.

fc02346_en

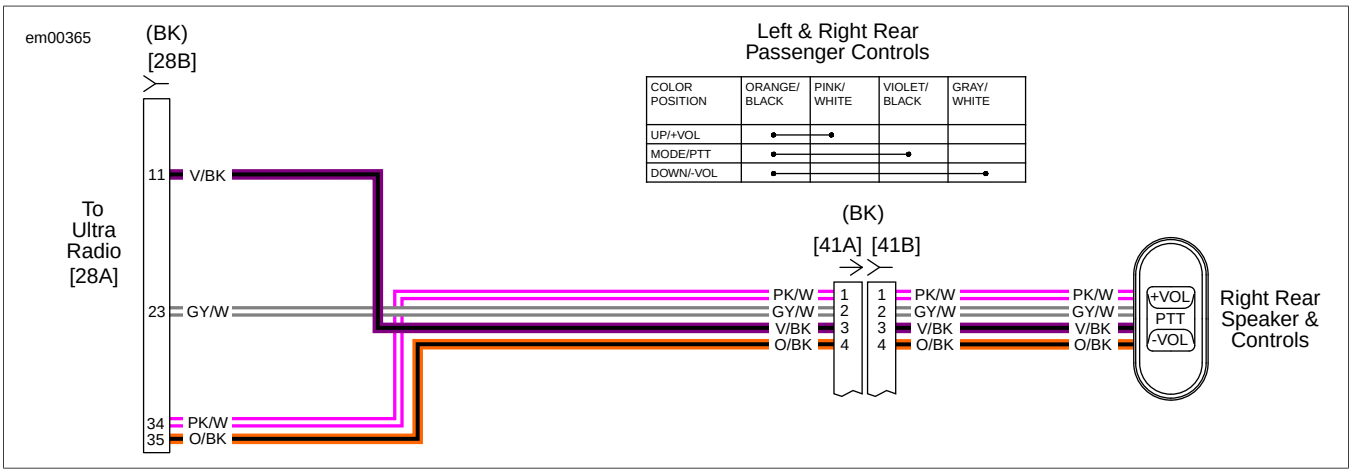


Figure 5-40. Passenger Audio/PTT Switch Circuit

Table 5-43. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[41]	Rear right speaker/pas-senger controls	6-Place Mini-Deutsch	Inside rear right speaker box

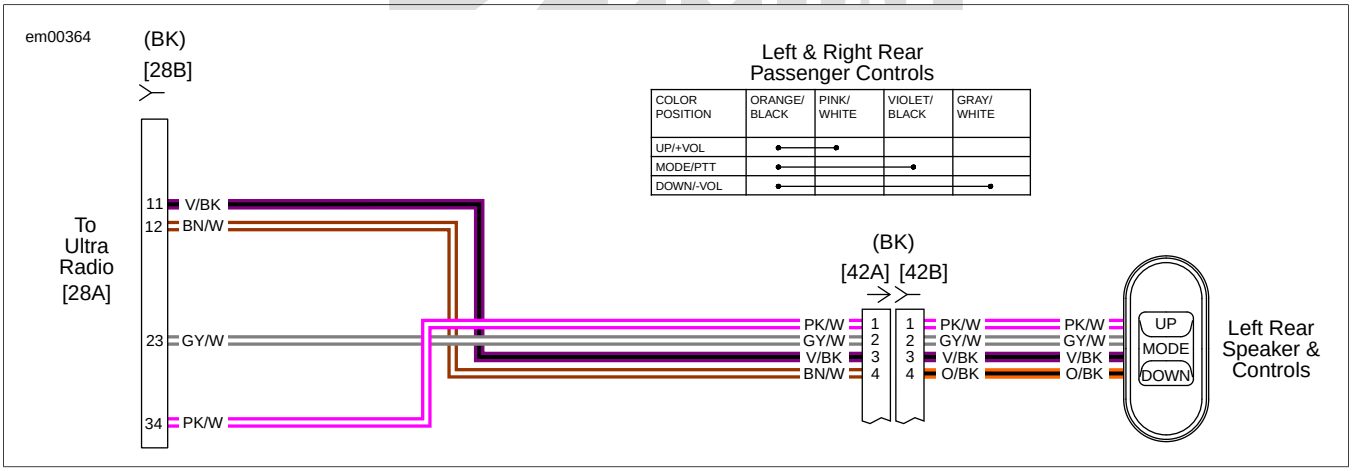
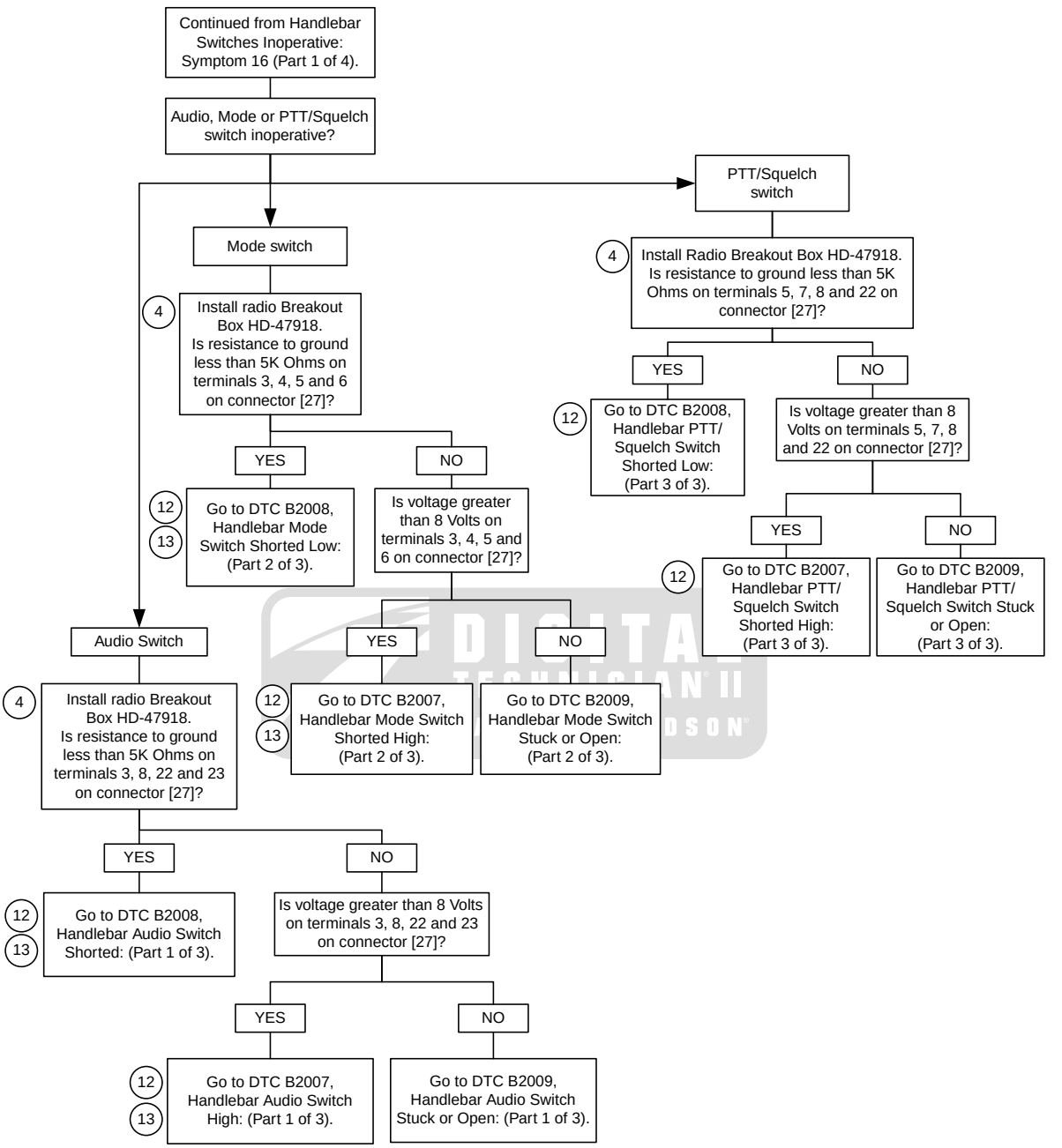


Figure 5-41. Passenger Mode Switch Circuit

Table 5-44. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[42]	Rear left speaker/passenger controls	6-Place Mini-Deutsch	Inside rear left speaker box

Handlebar, Passenger or Sidecar Switches Inoperative: Symptom 16 (Part 3 of 4)



Confirm proper operation with no DTCs.

fc02347_en

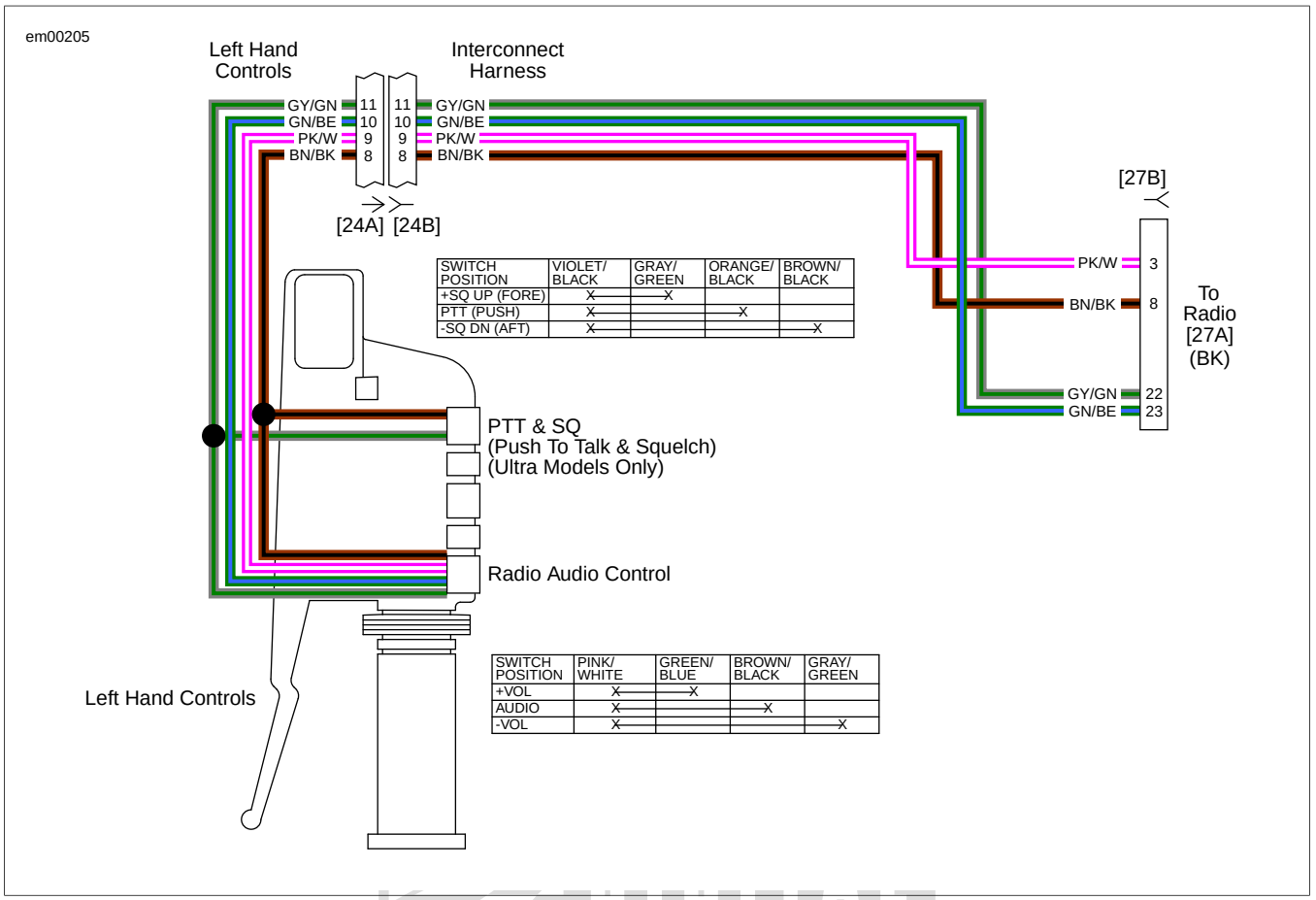


Figure 5-42. Handlebar Audio Switch Circuit

Table 5-45. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[24]	Interconnect harness to left handlebar switches	16-Place Molex (Gray)	Inner fairing - left fairing support brace
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)

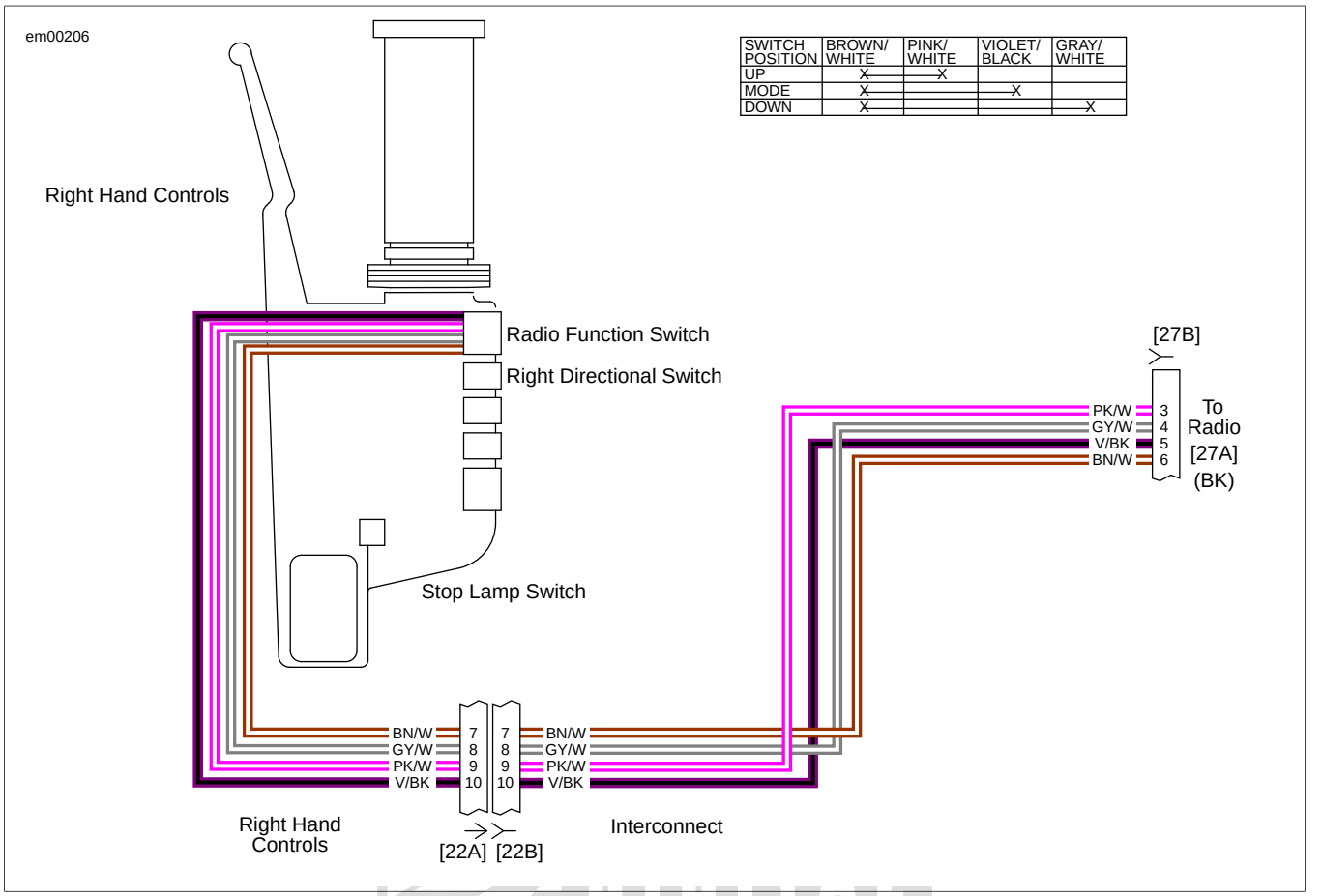


Figure 5-43. Handlebar Mode Switch Circuit

Table 5-46. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Interconnect harness to right handlebar switches	12-Place Molex (Black)	Inner fairing - right fairing support brace
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)

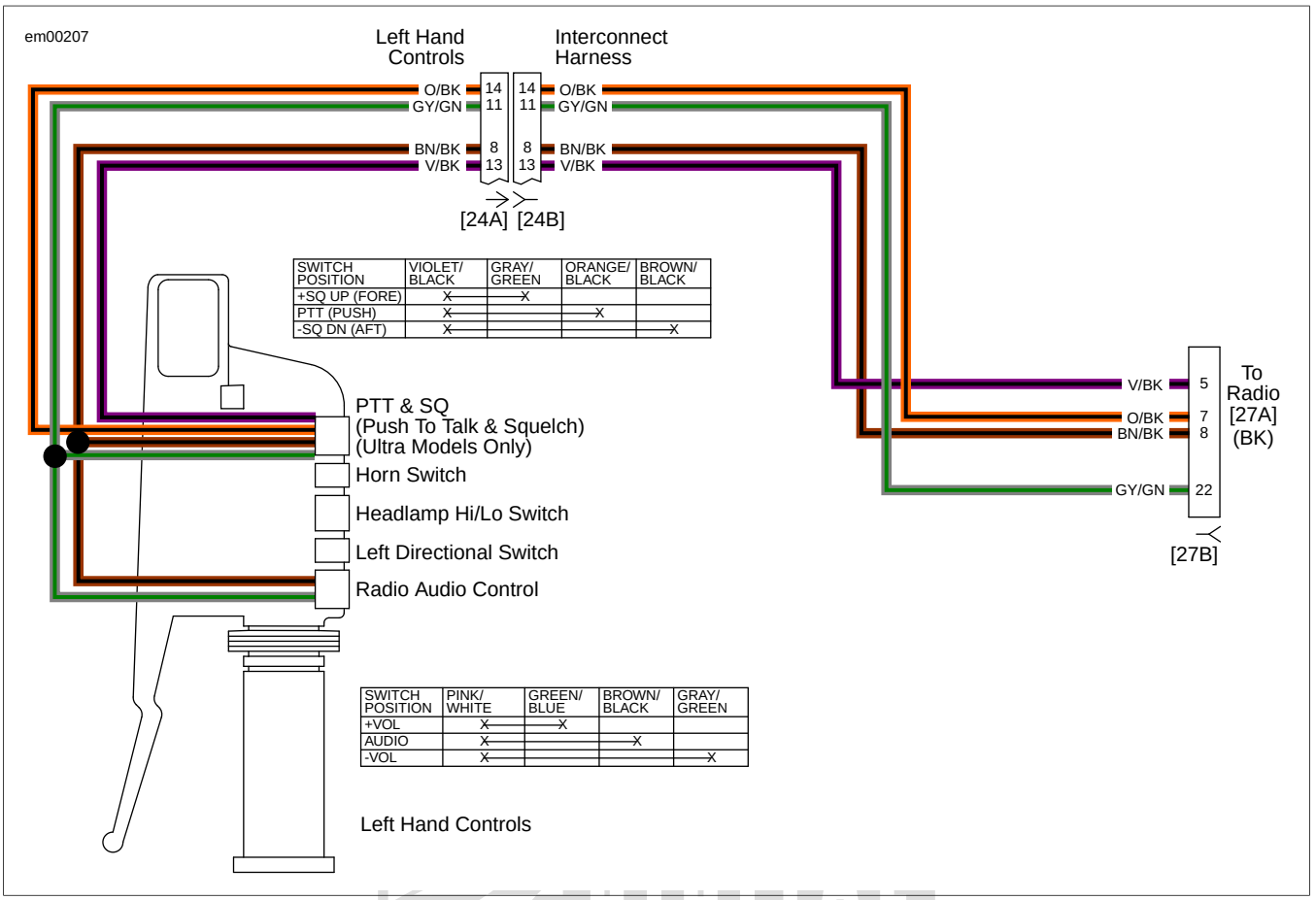
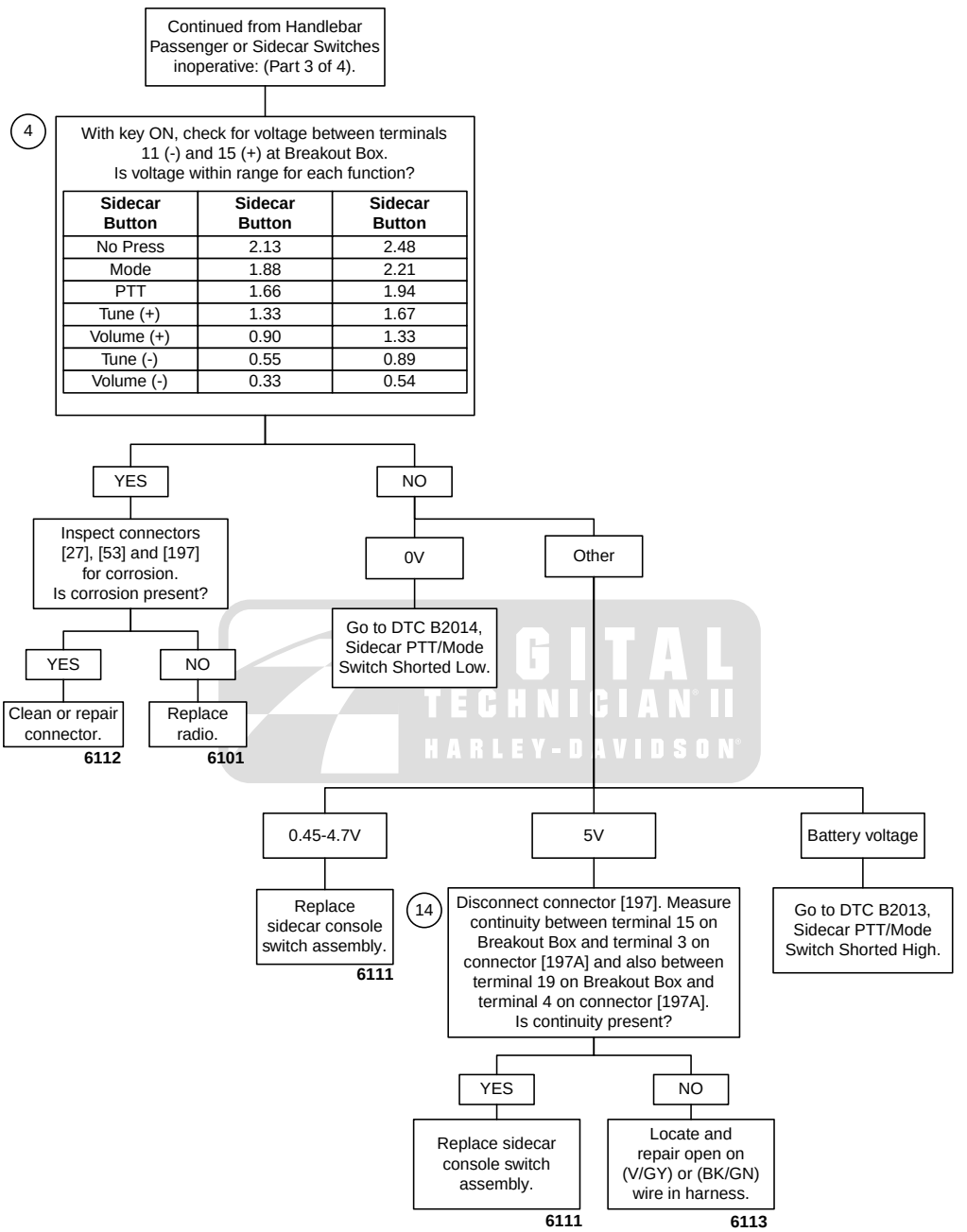


Figure 5-44. Handlebar PTT/Squelch Switch Circuit

Table 5-47. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[24]	Interconnect harness to left handlebar switches	16-Place Molex (Gray)	Inner fairing - left fairing support brace
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)

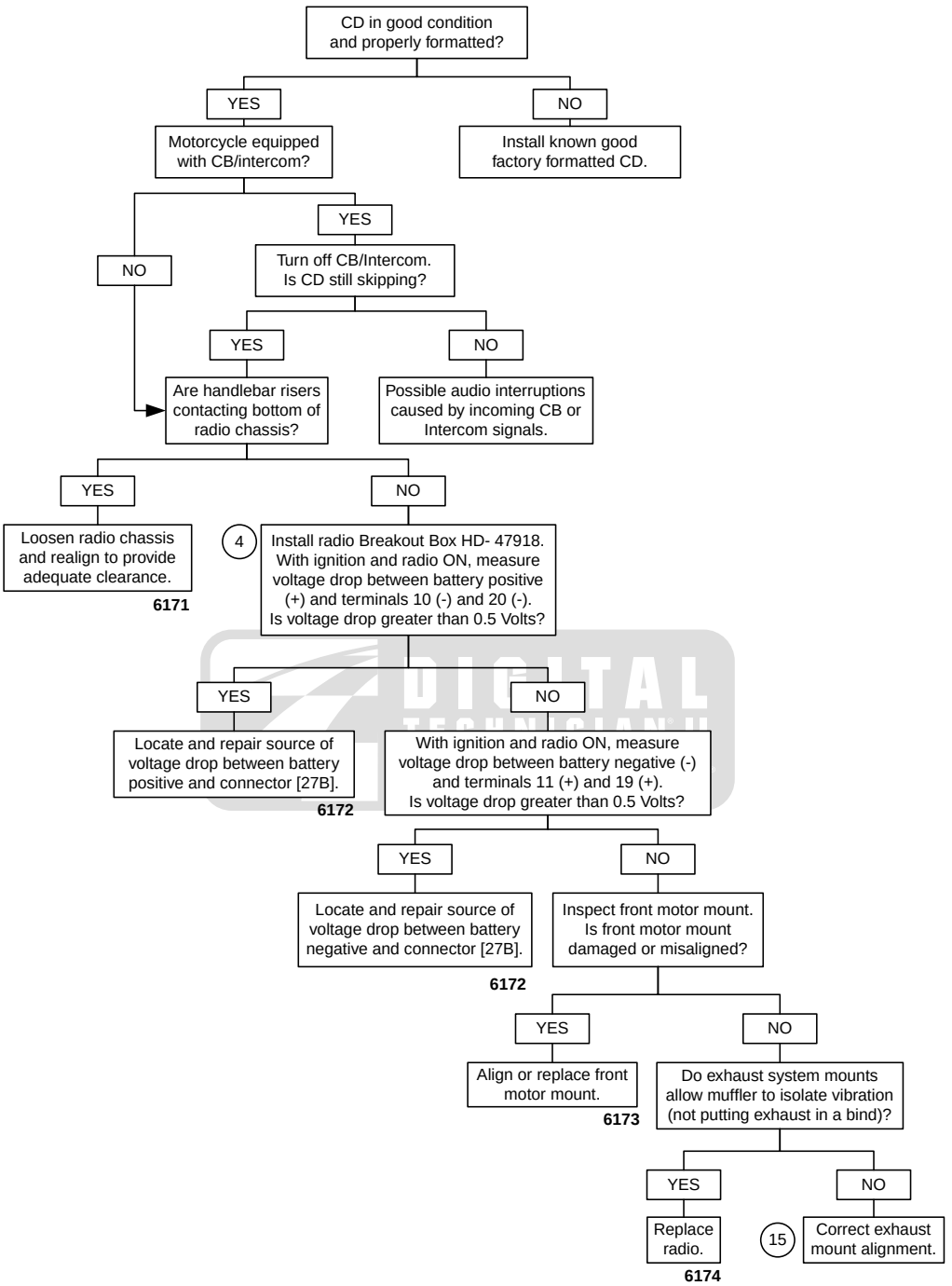
Handlebar, Passenger or Sidecar Switches Inoperative: Symptom 16 (Part 4 of 4)



Confirm proper operation with no DTCs.

fc02348_en

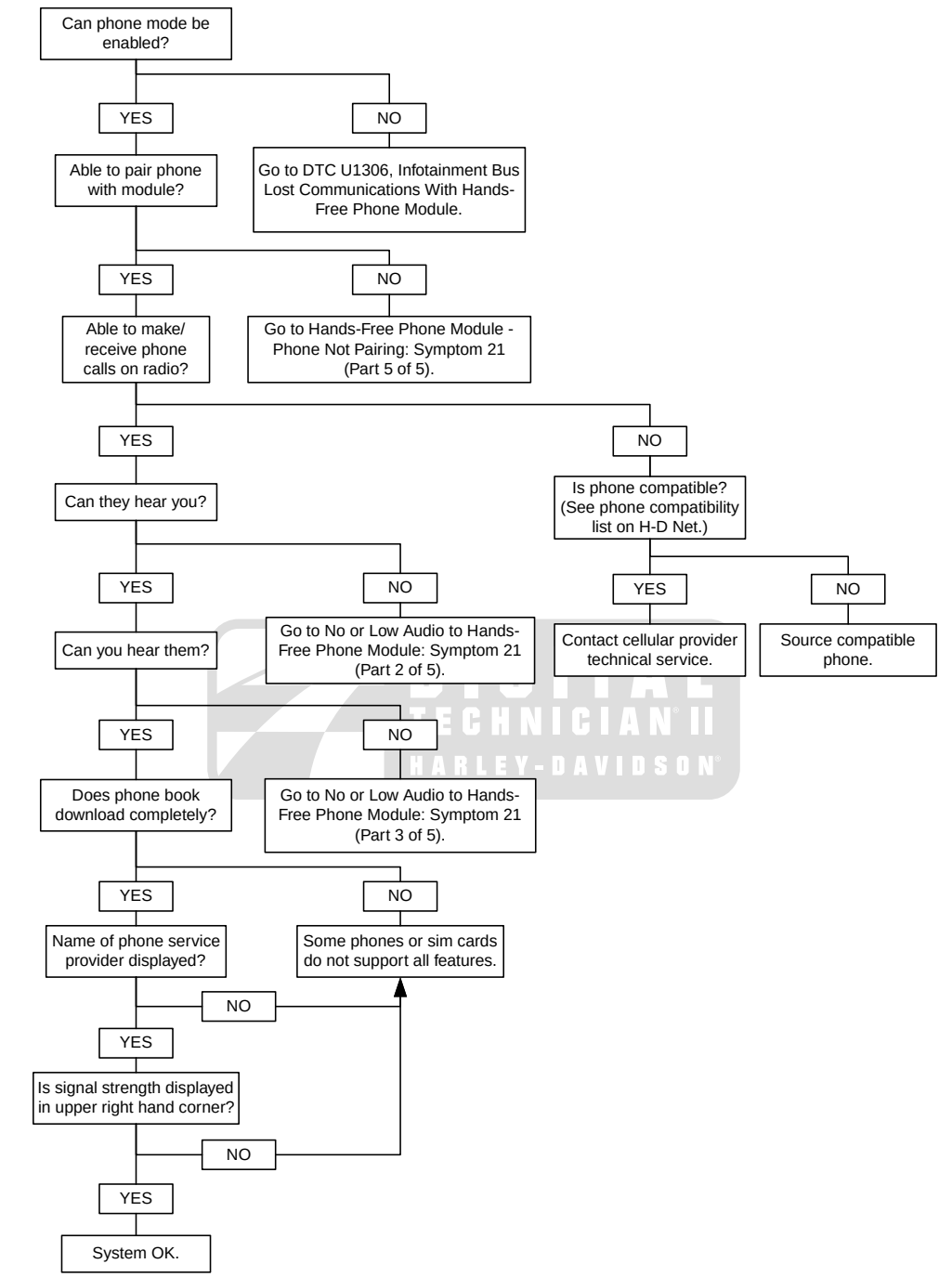
CD Skipping: Symptom 17



Confirm proper operation with no DTCs.

fc02349_en

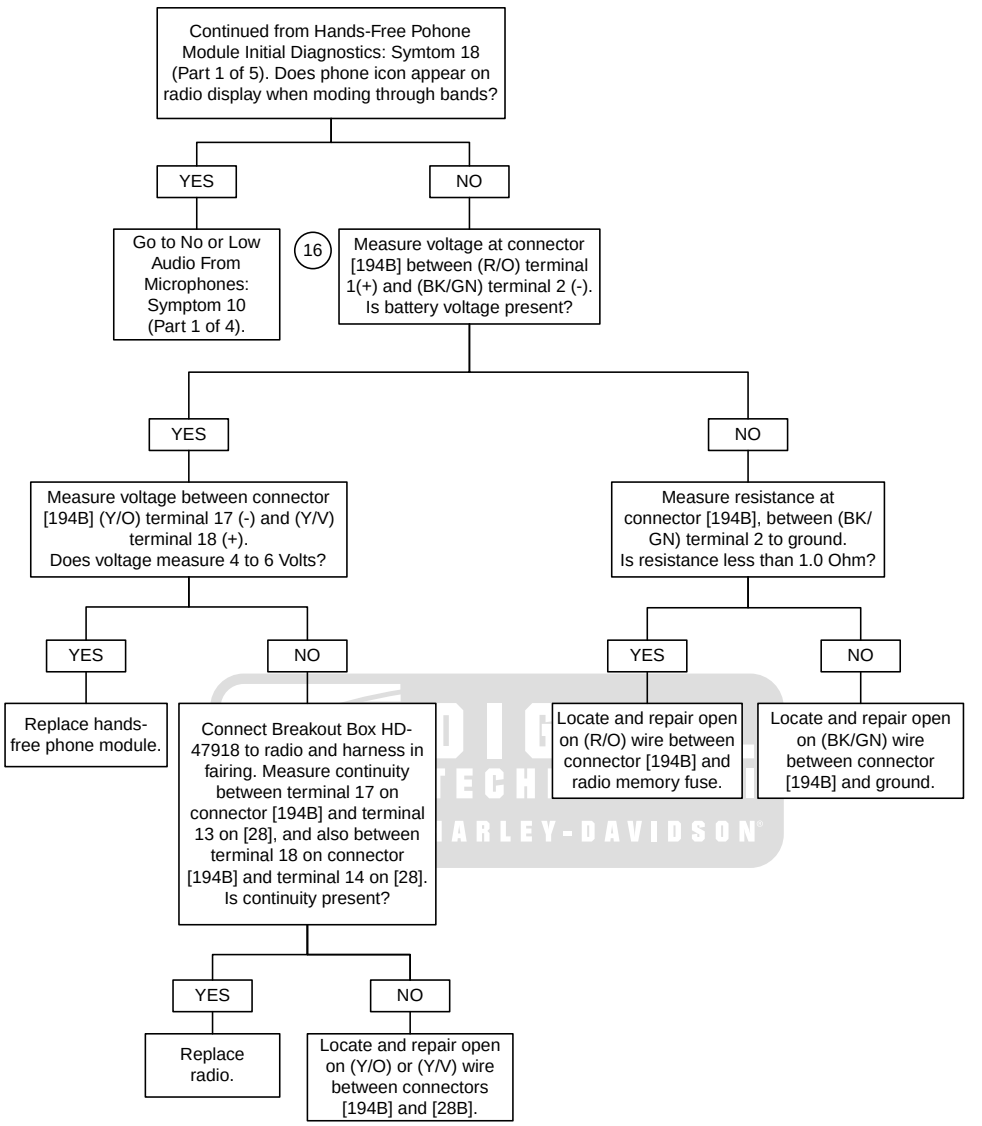
Hands-Free Phone Module Initial Diagnostics: Symptom 18 (Part 1 of 5)



Confirm proper operation with no DTCs.

fc02350_en

Hands-Free Phone Module Initial Diagnostics: Symptom 18 (Part 2 of 5)





Confirm proper operation with no DTCs.

fc02351_en

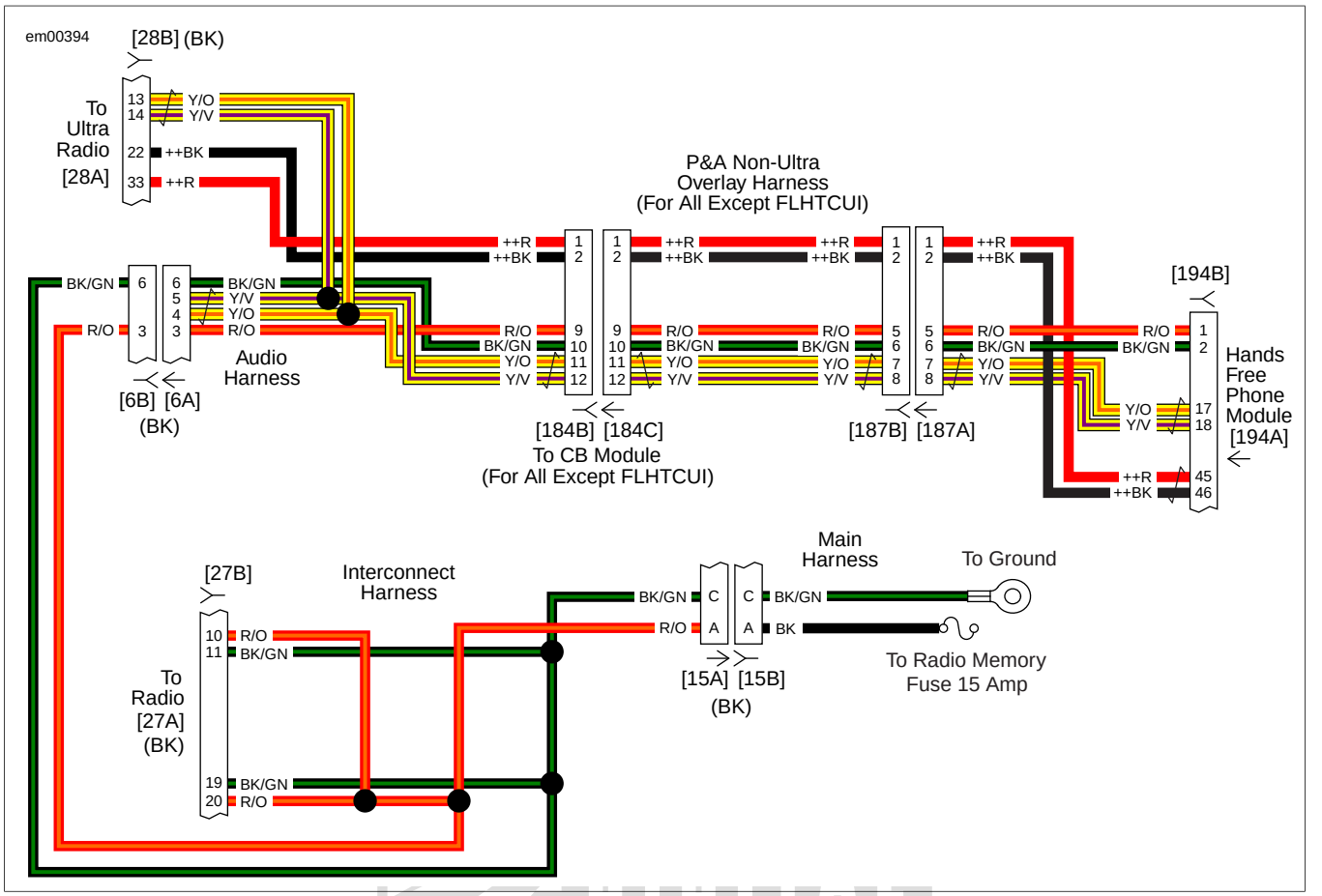
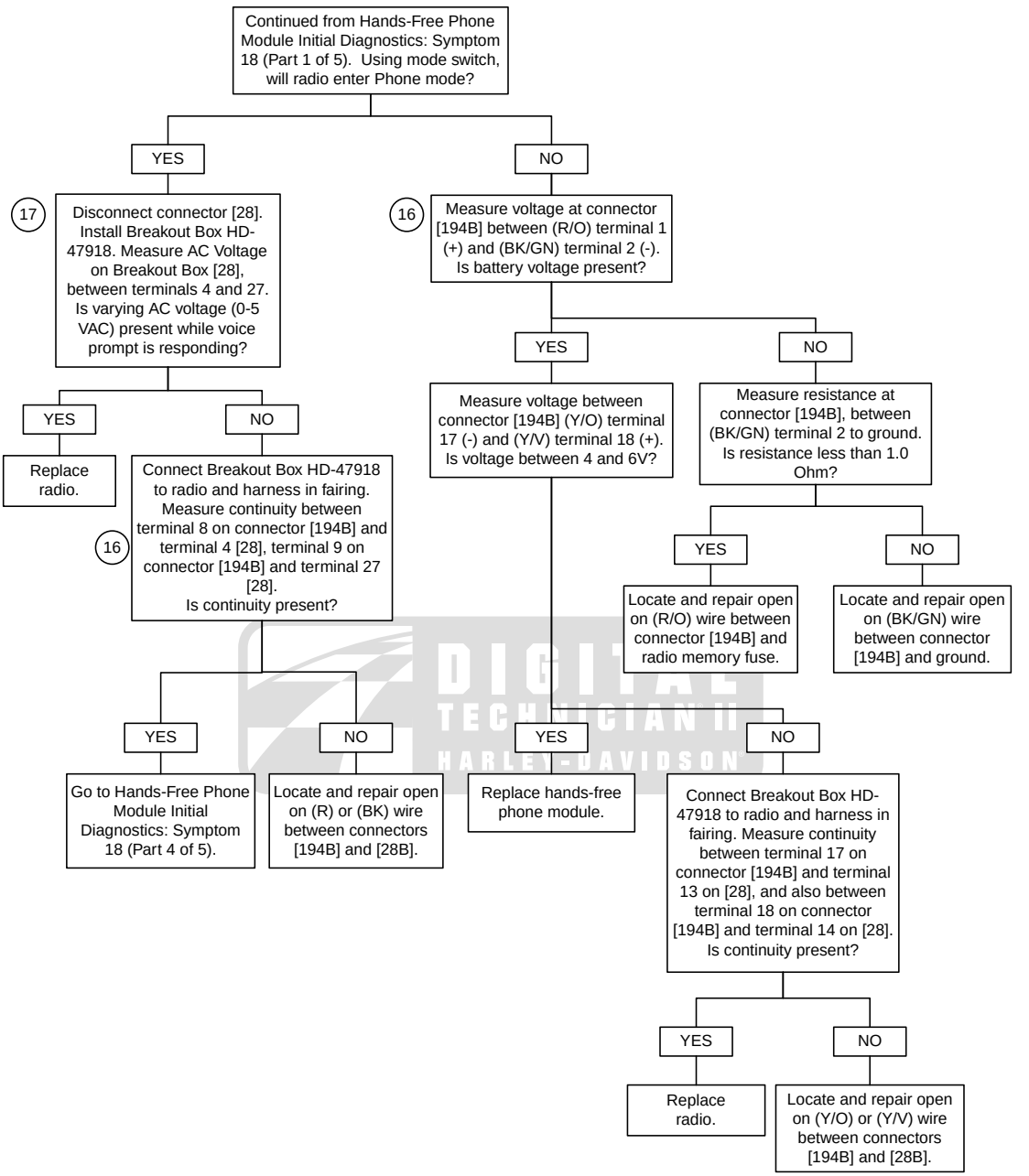


Figure 5-45. Hands-Free Phone Circuit

Table 5-48. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect harness	6-Place Deutsch (Black)	Inner fairing - left side of radio
[15]	Main to interconnect harness	4-Place Packard	Inner fairing - right fairing bracket
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[187]	Hands-free phone module	12-Place Mini-Deutsch	Inner fairing - top of radio (left side)
[194]	Hands-free phone module	54-Place Amp	Inside TourPak (left side)

Hands-Free Phone Module Initial Diagnostics: Symptom 18 (Part 3 of 5)



Confirm proper operation with no DTCs.

fc02352_en

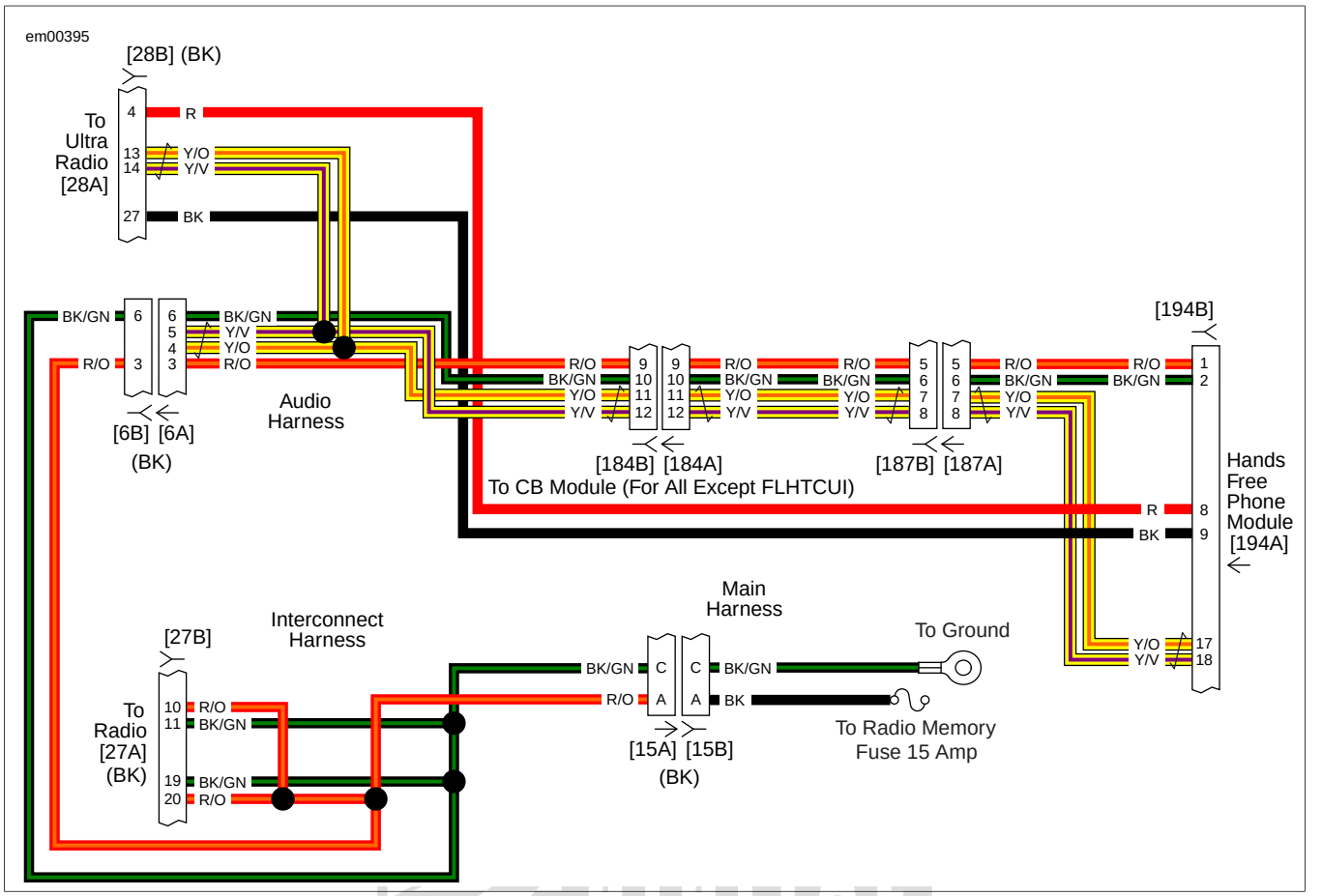
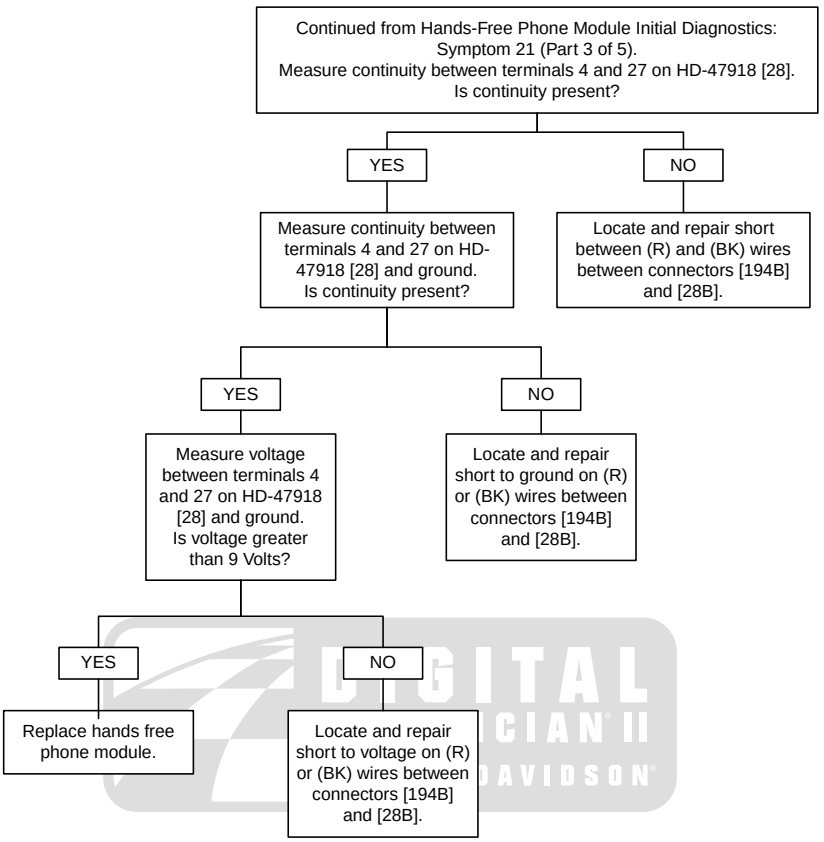


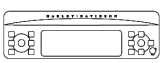
Figure 5-46. Hands-Free Phone Circuit

Table 5-49. FLHT/C/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[6]	Audio to interconnect harness	6-Place Deutsch (Black)	Inner fairing - left side of radio
[15]	Main to interconnect harness	4-Place Packard	Inner fairing - right fairing bracket
[27]	Radio	23-Place Amp	Inner fairing - back of radio (right side)
[28]	Radio	35-Place Amp	Inner fairing - back of radio (left side)
[187]	Hands-free phone module	12-Place Mini-Deutsch	Inner fairing - top of radio (left side)
[194]	Hands-free phone module	54-Place Amp	Inside TourPak (left side)

Hands-Free Phone Module Initial Diagnostics: Symptom 18 (Part 4 of 5)

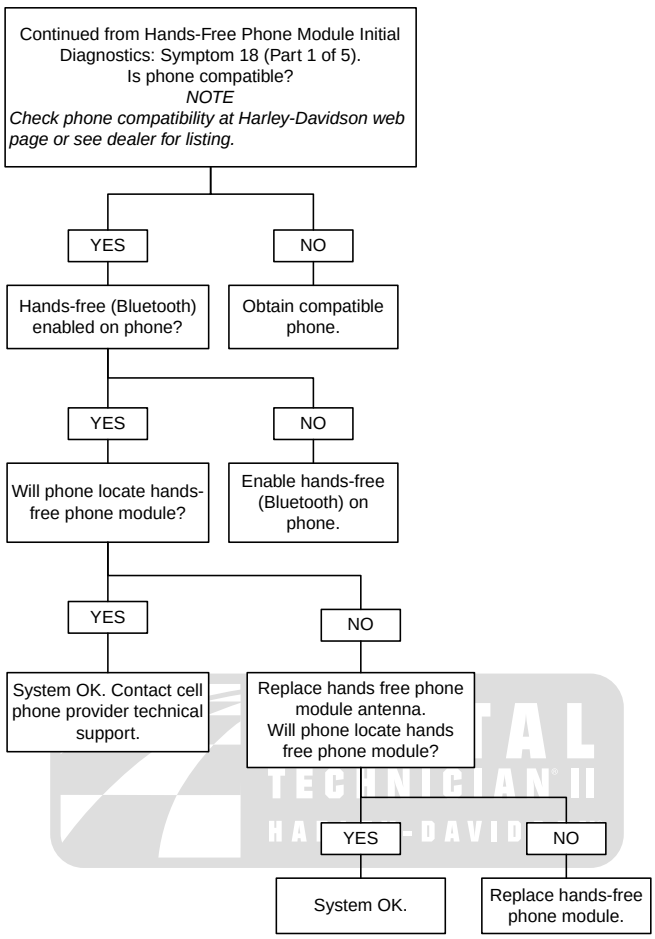


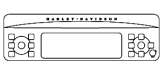


Confirm proper operation with no DTCs.

fc02353_en

Hands-Free Phone Module Initial Diagnostics: Symptom 18 (Part 5 of 5)





Confirm proper operation with no DTCs.

fc02354_en

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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

ANTI-LOCK BRAKE SYSTEM (ABS) GENERAL INFORMATION 6.1

ABS DESCRIPTION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

ABS

The ABS module controls brake application under extreme stopping conditions in order to keep the wheels from slipping. When wheel slip is detected during a brake application, an ABS event occurs. The hydraulic pressure to the individual wheel is controlled to prevent slipping on that wheel. Specific valves and individual hydraulic lines are provided for each wheel. The ABS can decrease, hold, or increase fluid pressure to each brake. However, the ABS cannot increase hydraulic pressure above the pressure being transmitted by the master cylinder.

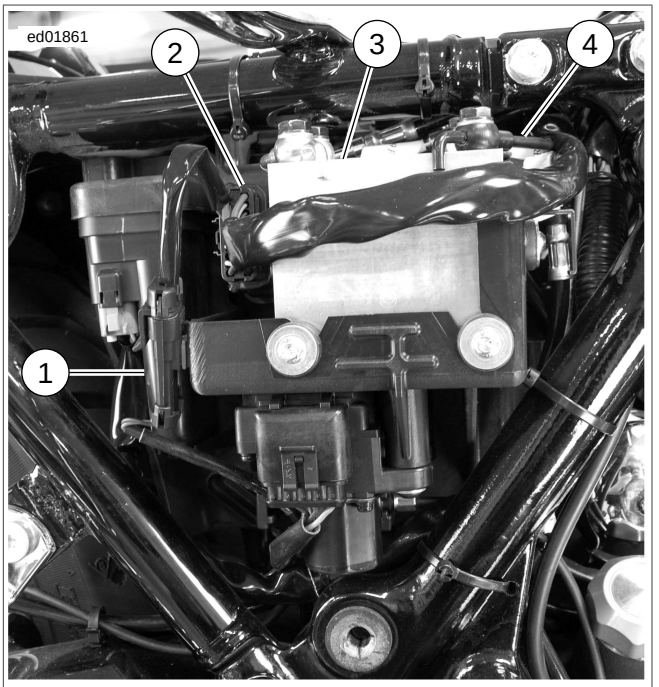
During an ABS event, a series of rapid pulsations may be felt in either the front brake lever or rear brake pedal. These pulsations are caused by the rapid changes in position of the individual solenoid valves as the ABS responds to wheel speed sensor inputs and attempts to prevent wheel slip. These pulsations are present only during initialization and anti-lock braking. The pulsations stop when normal braking is resumed or when the vehicle comes to a stop. A ticking or popping noise may also be heard as the solenoid valves cycle rapidly. During anti-lock braking on dry pavement, intermittent chirping noises may be heard as the tires approach slipping. These noises and pulsations are considered normal during anti-lock operation.

Vehicles equipped with ABS may be stopped by applying normal pressure to the brake pedal or lever. Brake operation during normal braking is no different then that of previous non-ABS systems. Maintaining a constant pressure on the brake pedal or lever provides the shortest stopping distance while maintaining vehicle stability.

In addition to the normal brake system, the ABS consists of the following components.

- See Figure 6-1. Electronic Control Unit (ECU): The ECU contains the motor relay, valve relay, system enable relay, and the solenoids.
- See Figure 6-1. Hydraulic Control Unit (HCU): The HCU contains the four valves (an apply valve and release valve for each wheel), two pumps, pump motor, and accumulators.
- See Figure 6-2. Front Wheel Speed Sensor.
- See Figure 6-3. Rear Wheel Speed Sensor.
- See Figure 6-4. ABS Diode Pack.

When refering to the ECU and the HCU as a unit they are referred to as the ABS module.



1. **Rear Wheel Speed Sensor connector**
2. **ECU connector**
3. **HCU**
4. **ECU**

Figure 6-1. ABS Module

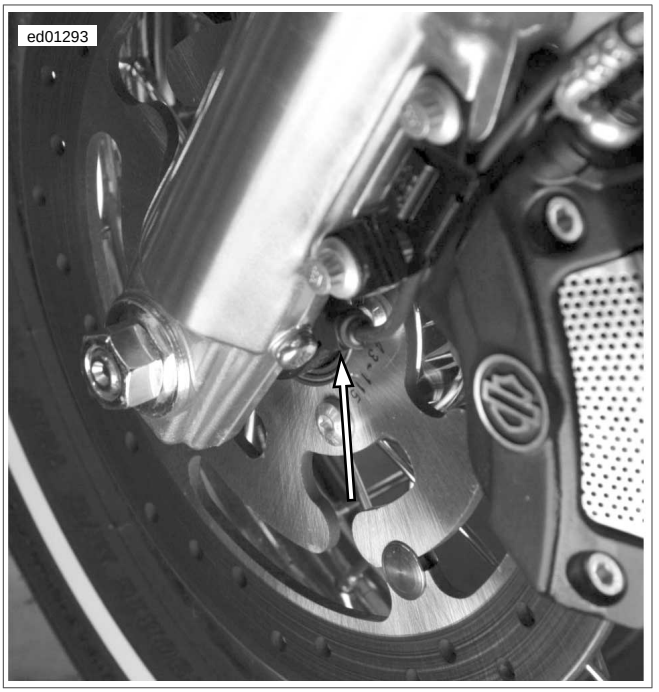


Figure 6-2. Front Wheel Speed Sensor

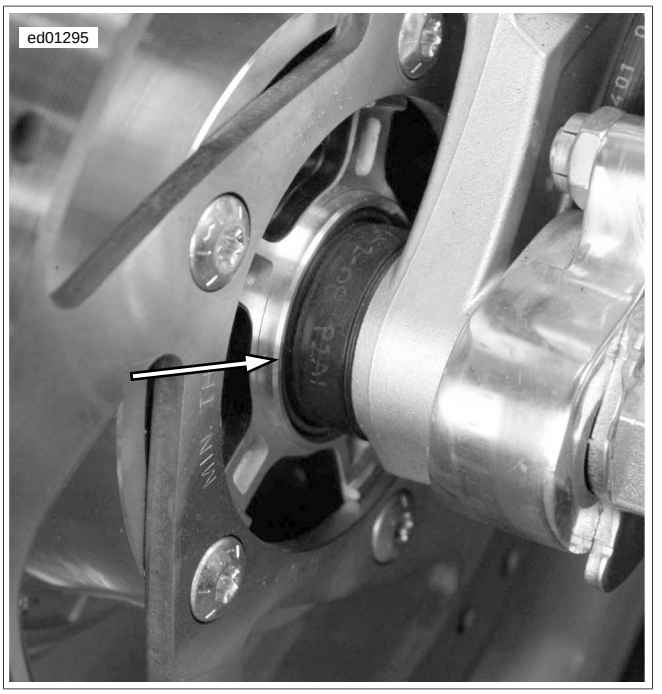


Figure 6-3. Rear Wheel Speed Sensor



Figure 6-4. ABS Diode Pack

Pressure Hold

The ECU closes the apply valve and keeps the release valve closed in order to isolate the slipping wheel when wheel slip occurs. This holds the pressure steady on the brake so the hydraulic pressure does not increase or decrease.

Pressure Decrease

If a pressure hold does not correct the wheel slip condition, a pressure decrease occurs. The apply valve is closed and the release valve is opened. The excess fluid is stored in the accumulator until the pump can return the fluid to the master cylinder or fluid reservoir.

Pressure Increase

After the wheel slip is corrected, a pressure increase occurs. The ECU increases the pressure to individual wheels during deceleration in order to reduce the speed of the wheel. The apply valve is opened and the release valve is closed. The increased pressure is delivered from the master cylinder and will not exceed the pressure from the master cylinder.

Initialization Self-Test

The ABS module performs one initialization self-test each ignition cycle. The ABS module verifies internal circuitry and the wheel speed sensor circuits.

As part of the initialization self-test the ABS module also does a modular test. This test consists of energizing the actuators, and commanding the motor and solenoids on and off. The ABS module runs this test the first time the vehicle speed exceeds 10 MPH (16 km/h) in an ignition cycle or when all the following conditions are met for the first time in an ignition cycle:

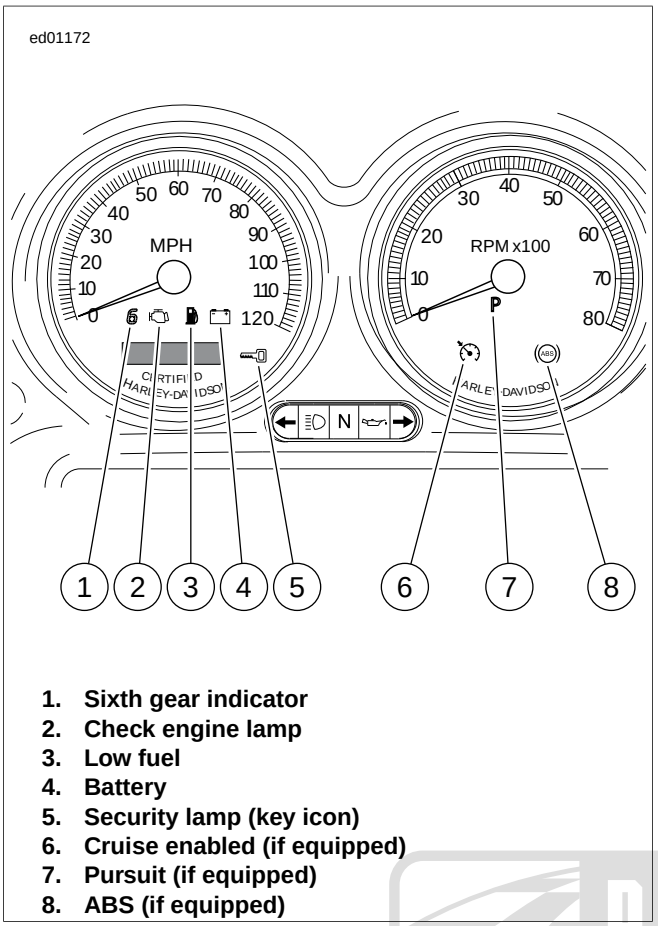
- brake switch is not applied.
- engine is above 500 RPM.
- no ABS event present.
- the system ECU is enabled.
- the ABS system is not communicating with DIGITAL TECHNICIAN II (Part No. HD-48650).

ABS Indicator

See Figure 6-5. The speedometer illuminates the ABS indicator when the following occurs:

- the ECU detects an ABS disabling malfunction. The ECU sends a serial data message to the instrument requesting illumination.
- the speedometer performs a bulb check.
- the speedometer detects a loss of communication with the ECU.

The ECU sends a message to the speedometer or tachometer (depending upon model) when a malfunction that disables ABS operation is detected. Depending on the fault the ABS indicator may stay on even after the malfunction is corrected. The indicator does not go off until the vehicle is operated at speeds greater than 10 MPH (16 km/h). It is important to verify that this is not the cause of an illuminated ABS indicator when no DTCs are set, before attempting to diagnose other possible causes.



1. **Sixth gear indicator**
2. **Check engine lamp**
3. **Low fuel**
4. **Battery**
5. **Security lamp (key icon)**
6. **Cruise enabled (if equipped)**
7. **Pursuit (if equipped)**
8. **ABS (if equipped)**

Figure 6-5. Instrument (Typical)

CODE TYPES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

There are two types of DTCs; current and historic. If a DTC is stored, it can be read using either a computer based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650) or Speedometer Self-Diagnostics. See 6.2 SPEEDOMETER SELF-DIAGNOSTICS.

NOTES

- *Speedometer self-diagnostics display both current and historic DTCs. To differentiate between current and historic DTCs, use a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650).*
- *All DTCs reside in the memory of ECM, TSM/TSSM/HFSM, speedometer, tachometer, or ABS module until the DTC is cleared using Speedometer Self-Diagnostics. See 6.2 SPEEDOMETER SELF-DIAGNOSTICS.*
- *A historic DTC is also cleared after a total of 50 ignition cycles (start and run cycle) has elapsed. After the 50 ignition cycle retention period, the DTC is automatically erased from memory providing no subsequent faults of the same type are detected in that period.*

Current

Current DTCs are those which are present during the current ignition cycle. See the appropriate flowcharts for solutions.

Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic rather than a current DTC.

Historic DTCs are stored for 50 ignition cycles after any DTC was last set as current to assist in the diagnosis of intermittent faults. On the 50th cycle, the DTC clears itself. The security lamp only indicates the existence of historic DTCs for two ignition cycles.

It is important to note that historic DTCs may also be present whenever the system indicates the existence of a current fault. See 6.1 ANTI-LOCK BRAKE SYSTEM (ABS) GENERAL INFORMATION, Multiple Trouble Codes if multiple DTCs are found.

Diagnostic charts are designed for use with current DTCs and as a result they frequently suggest wire repair or part replacement. When diagnosing a historic DTC the charts can be helpful but should not lead to part replacement without verification the part is faulty.

RETRIEVING DTCS

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

There are two levels of diagnostics:

- The most sophisticated mode uses a computer-based diagnostic package called the DIGITAL TECHNICIAN II (Part No. HD-48650).
- The second mode requires using speedometer self-diagnostics. TSM/TSSM/HFSM, ABS, and ECM codes can be accessed and cleared. See 6.2 SPEEDOMETER SELF-DIAGNOSTICS for more information.

MULTIPLE TROUBLE CODES

While it is possible for more than one fault to occur and set more than one DTC, there are several conditions which may result in one fault setting multiple DTCs:

Serial data codes (DTC U1300, U1301, U1016, U1097 and U1098) may be accompanied by other codes. Always correct the serial data codes before resolving the other codes.

SPEEDOMETER SELF-DIAGNOSTICS 6.2

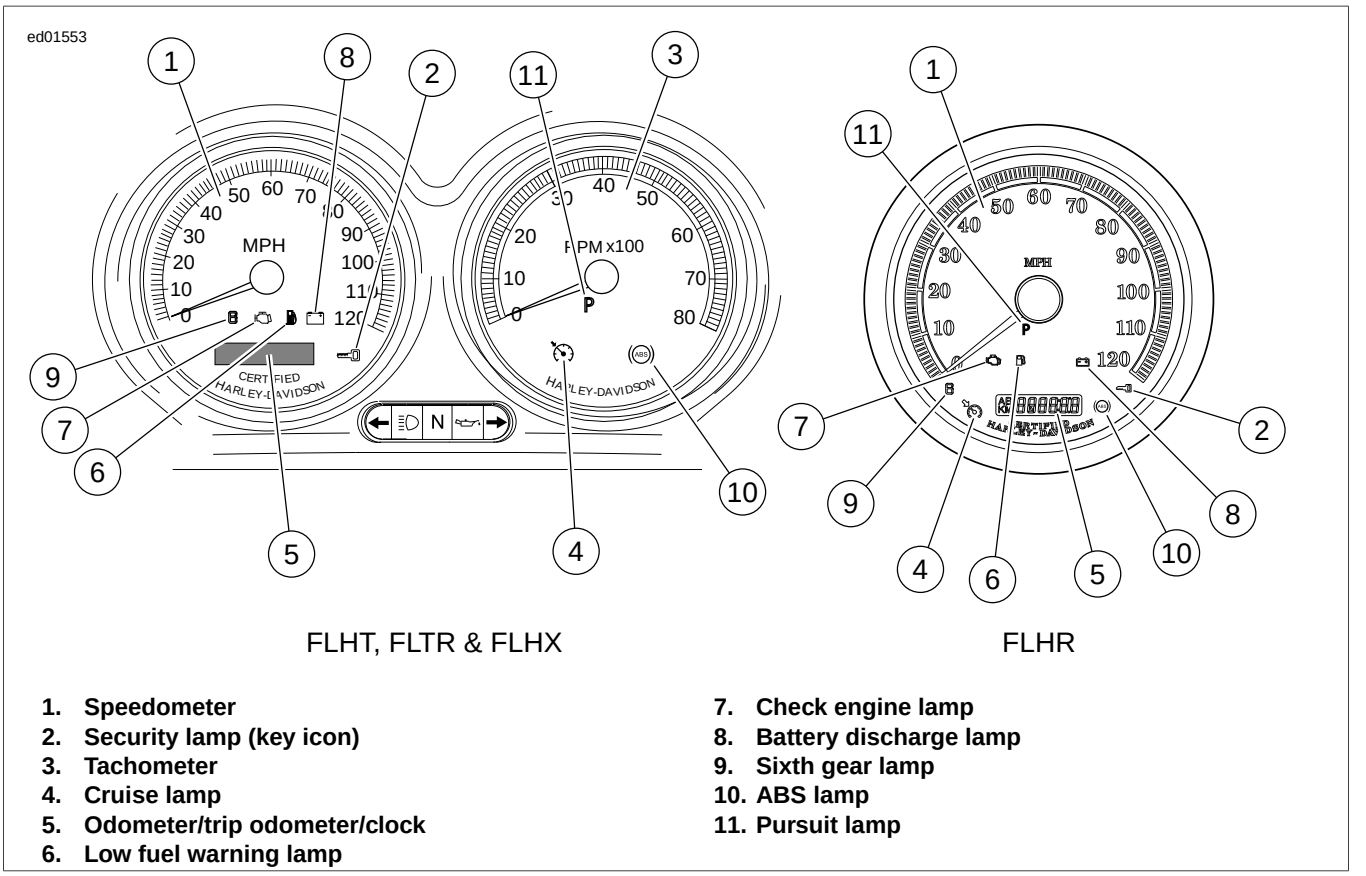
GENERAL

The speedometer is capable of displaying and clearing speedometer, tachometer, TSM/HFSM, ABS, and ECM DTCs (diagnostic mode).

DIAGNOSTICS

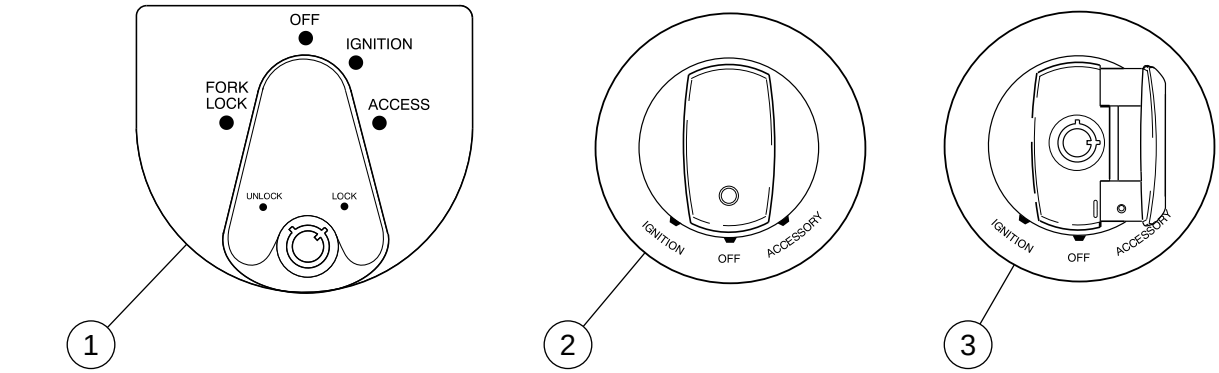
Diagnostic Tips

- For a quick check of speedometer function, perform a "WOW" test. For model specific instruments and ignition switches, see Figure 6-6 and Figure 6-7, respectively. While pressing the trip odometer reset switch, turn ignition switch to IGNITION. Background lighting should illuminate, gauge needles should sweep their full range of motion and indicator lamps controlled by the serial data bus (battery and check engine) should illuminate.
- If speedometer fails "WOW" test, check for battery, ground and accessory to speedometer. If any feature in the speedometer is non-functional, see 6.4 INITIAL DIAGNOSTIC CHECK: ABS.



1. **Speedometer**
2. **Security lamp (key icon)**
3. **Tachometer**
4. **Cruise lamp**
5. **Odometer/trip odometer/clock**
6. **Low fuel warning lamp**
7. **Check engine lamp**
8. **Battery discharge lamp**
9. **Sixth gear lamp**
10. **ABS lamp**
11. **Pursuit lamp**

Figure 6-6. Instrument



1. **All except FLHR models**
2. **All FLHR models (cover shown closed)**
3. **All FLHR models (cover shown open)**

Figure 6-7. Ignition Switch: Touring Models

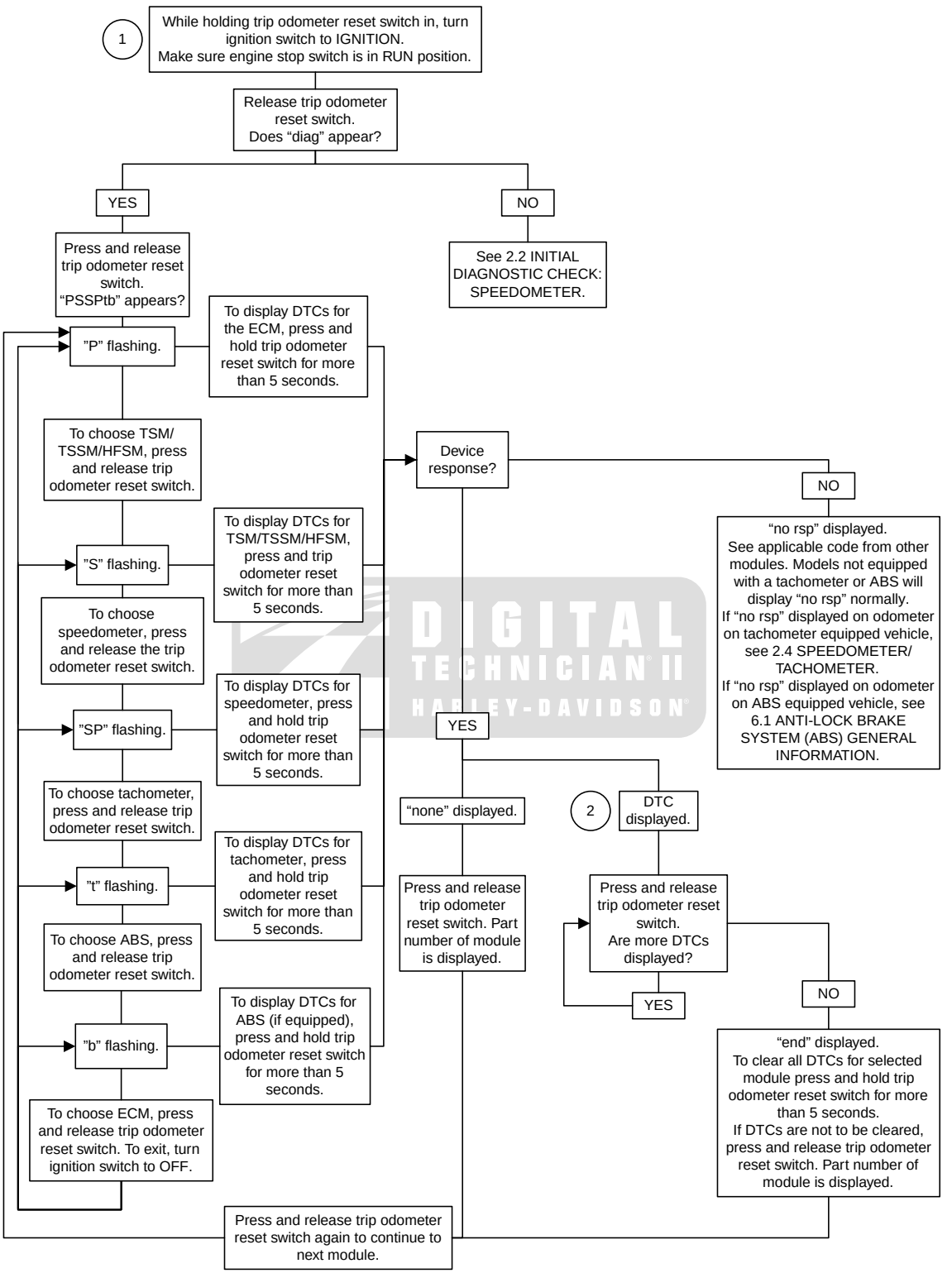
Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. To exit diagnostic mode, turn ignition switch to OFF.
2. To clear DTCs for selected module, press trip odometer reset switch for more than 5 seconds when code is displayed. This procedure clears all DTCs for selected module.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Speedometer Self-Diagnostics



fc02165_en

BREAKOUT BOX: ABS 6.3

GENERAL

PART NUMBER	TOOL NAME
HD-48642	BREAKOUT BOX

The BREAKOUT BOX (Part No. HD-48642) connects to the ABS module connector [166]. Used in conjunction with a DVOM, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects. See Figure 6-8 for ECU location.

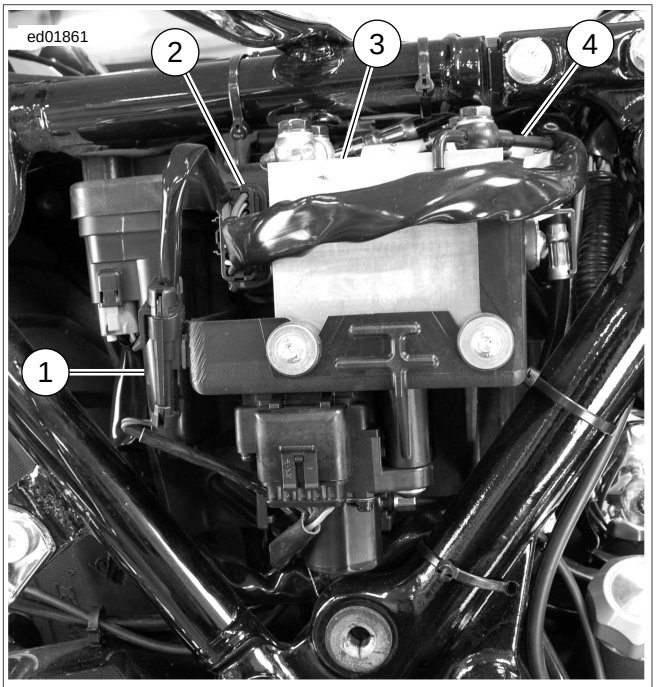
NOTE

See wiring diagrams for ABS terminal functions.

INSTALLATION

PART NUMBER	TOOL NAME
HD-46601	INSTRUMENT HARNESS ADAPTERS
HD48642	BREAKOUT BOX

1. Press latch on connector [166B].
2. Connect INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) to connectors [166A] and [166B].
3. Attach BREAKOUT BOX (Part No. HD48642) to connectors.
4. Attach connectors from BREAKOUT BOX (Part No. HD48642) to INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601).



1. **Rear Wheel Speed Sensor connector**
2. **ECU connector**
3. **HCU**
4. **ECU**

Figure 6-8. ABS Module

REMOVAL

PART NUMBER	TOOL NAME
HD-46601	INSTRUMENT HARNESS ADAPTERS
HD-48642	BREAKOUT BOX

1. Detach connectors from BREAKOUT BOX (Part No. HD-48642) to INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601).
2. Detach INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) from connectors [166A] and [166B].
3. Install connector [166B] to ABS module.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

INITIAL DIAGNOSTIC CHECK: ABS 6.4

GENERAL

PART NUMBER	TOOL NAME
HD-48642	BREAKOUT BOX

To locate faulty circuits or other system problems, follow the diagnostic flowcharts and tests in this section. For a systematic approach, always begin with 6.4 INITIAL DIAGNOSTIC CHECK: ABS, Initial Diagnostics. Read the general information and then work your way through the flowchart box by box.

Diagnostic Notes

If a numbered circle appears adjacent to a flowchart box, then more information is offered in the diagnostic notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual where information on the location and removal of components may be obtained.

Circuit Diagram/Wire Harness Connector Table

When working through a flowchart, refer to the illustrations, the associated circuit diagram and the wire harness connector table as necessary. The wire harness connector table for each circuit diagram identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a BREAKOUT BOX (Part No. HD-48642) and a DVOM are required. See 6.3 BREAKOUT BOX: ABS.

To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

INITIAL DIAGNOSTICS

Diagnostic Tips

- If speedometer reads "No Response" with the ignition switch turned to IGNITION (engine stop switch at RUN with the engine off), check data link for an open or short to ground between DLC [91A] terminal 3 and ECM, TSM/TSSM/HFSM, speedometer connector or tachometer (if equipped) connector. See 3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM.
- Check for an open data test terminal between data link connector [91A] terminal 3 and ECM. With ignition switch turned to IGNITION, serial data bus voltage should be typically 0.6-0.8 Volts. The range of acceptable operation is 0-7.0 Volts.
- If speedometer reads BUS Er (serial data bus error), refer to flowcharts in 4.5 INITIAL DIAGNOSTIC CHECK: EFI.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Compare engine behavior to symptom tables in 4.5 INITIAL DIAGNOSTIC CHECK: EFI.

All ABS DTCs are listed in Table 6-1.

Table 6-1. ABS Diagnostic Trouble Codes (DTCs) and Fault Conditions

DTC	RANKING	FAULT CONDITION	SOLUTION
C0562	18	Device voltage low	6.6 DTC C0562
C0563	19	System voltage high	6.7 DTC C0563
C1014	10	ECU internal fault	6.23 DTC C1014, C1055-C1066, C1118, C1121
C1017	17	Pump motor power circuit open fault	6.8 DTC C1017
C1018	16	Pump motor ground high resistance fault	6.9 DTC C1018
C1021	22	Front wheel speed sensor equals 0	6.10 DTC C1021, C1023
C1023	23	Rear wheel speed sensor equals 0	6.10 DTC C1021, C1023
C1025	24	Front wheel speed signal intermittent	6.11 DTC C1025, C1027, C1206, C1208
C1027	25	Rear wheel speed signal intermittent	6.11 DTC C1025, C1027, C1206, C1208
C1032	20	Front wheel speed sensor circuit open or shorted	6.12 DTC C1032, C1034
C1034	21	Rear wheel speed sensor circuit open or shorted	6.12 DTC C1032, C1034
C1042	11	Pump motor open	6.13 DTC C1042

Table 6-1. ABS Diagnostic Trouble Codes (DTCs) and Fault Conditions

DTC	RANKING	FAULT CONDITION	SOLUTION
C1043	12	Pump motor stalled	6.14 DTC C1043
C1055	1	ECU internal fault	6.23 DTC C1014, C1055-C1066, C1118, C1121
C1056	2	ECU internal fault	6.23 DTC C1014, C1055-C1066, C1118, C1121
C1057	3	ECU internal fault	6.23 DTC C1014, C1055-C1066, C1118, C1121
C1061	4	ECU internal fault	6.23 DTC C1014, C1055-C1066, C1118, C1121
C1062	4	ECU internal fault	6.23 DTC C1014, C1055-C1066, C1118, C1121
C1065	6	ECU internal fault	6.23 DTC C1014, C1055-C1066, C1118, C1121
C1066	7	ECU internal fault	6.23 DTC C1014, C1055-C1066, C1118, C1121
C1094	28	Front brake switch always on	6.15 DTC C1094
C1095	29	Front brake switch open	6.16 DTC C1095
C1118	8	ECU internal fault	6.23 DTC C1014, C1055-C1066, C1118, C1121
C1121	9	ECU internal fault	6.23 DTC C1014, C1055-C1066, C1118, C1121
C1151	33	Front wheel release too long	6.17 DTC C1151
C1153	34	Rear wheel release too long	6.18 DTC C1153
C1158	15	Calibration programming required	6.19 DTC C1158
C1206	26	Wheel speed sensor frequency out of range	6.11 DTC C1025, C1027, C1206, C1208
C1208	27	Wheel speed sensor frequency out of range	6.11 DTC C1025, C1027, C1206, C1208
C1212	32	Front or rear brake not applied with decel	6.20 DTC C1212
C1214	30	Rear brake switch always on	6.21 DTC C1214
C1216	31	Rear brake switch open	6.22 DTC C1216
U1300	13	Serial data low	6.24 DTC U1300, U1301 OR BUS ER
U1301	14	Serial data open/high	6.24 DTC U1300, U1301 OR BUS ER

Other Diagnostic Trouble Codes (DTCs)

See 3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM for any DTCs related to the Turn Signal Module (TSM), Turn Signal Security Module (TSSM) or Hands-Free Security Module (HFSM).

See 4.5 INITIAL DIAGNOSTIC CHECK: EFI for any DTCs related to the ECM.

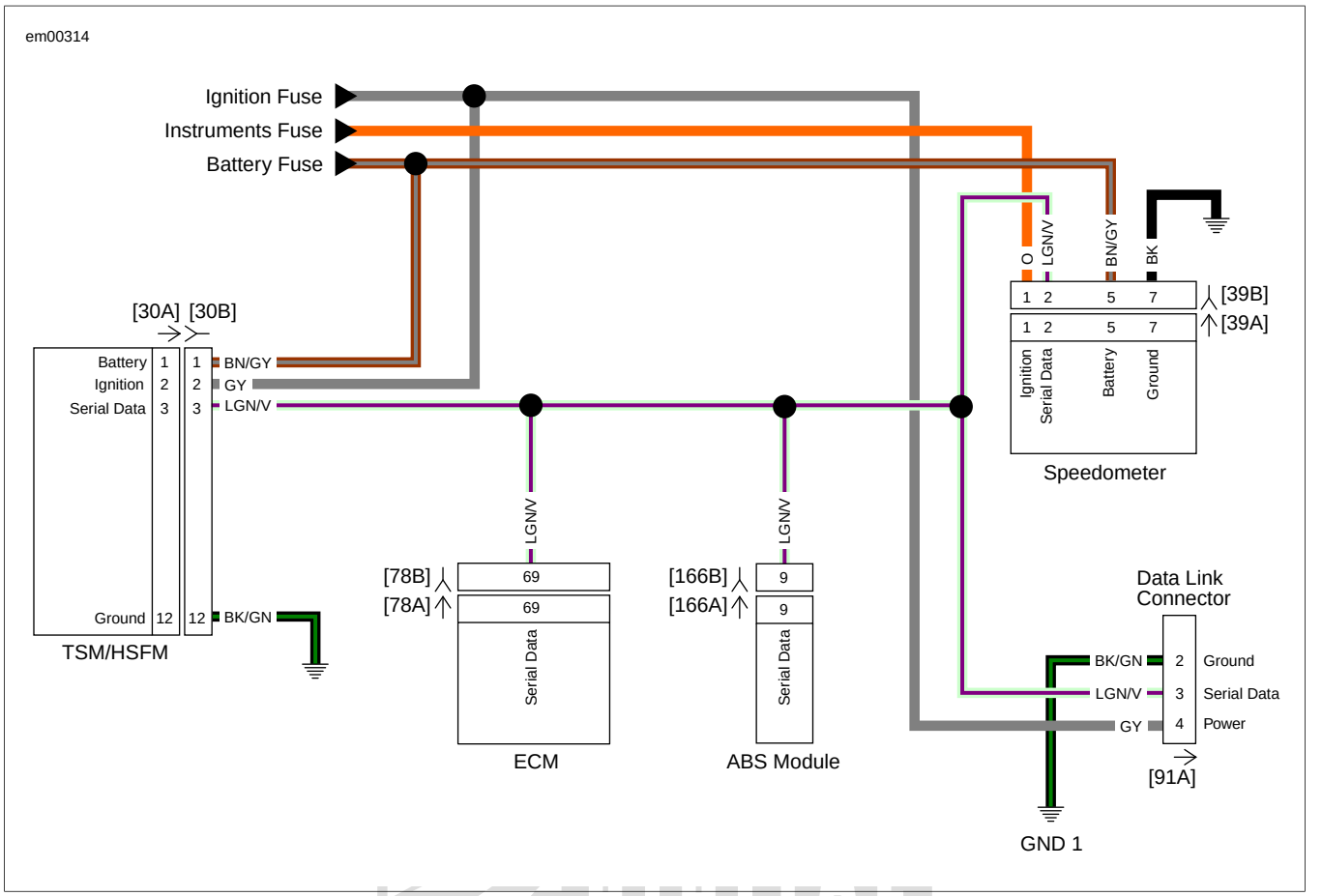
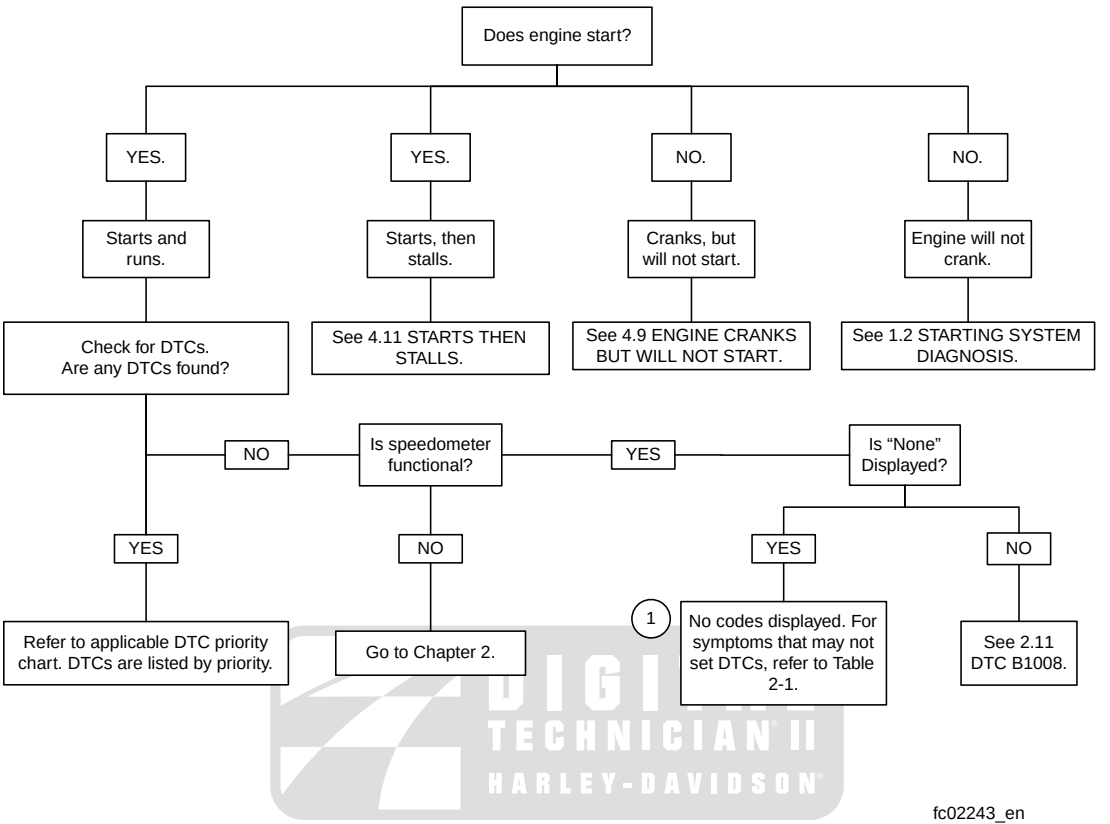


Figure 6-9. Diagnostic Check

Table 6-2. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[30]	TSM/TSSM/HFSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Packard	FLHT/C/U - inner fairing (back of speedometer) FLTR - under bezel (back of speedometer)
[78]	ECM	73-place Packard	Under seat
[91]	DLC	4-place Deutsch	Under left side cover
[166]	ABS module	20-place Molex	Under right side cover

Diagnostic Check



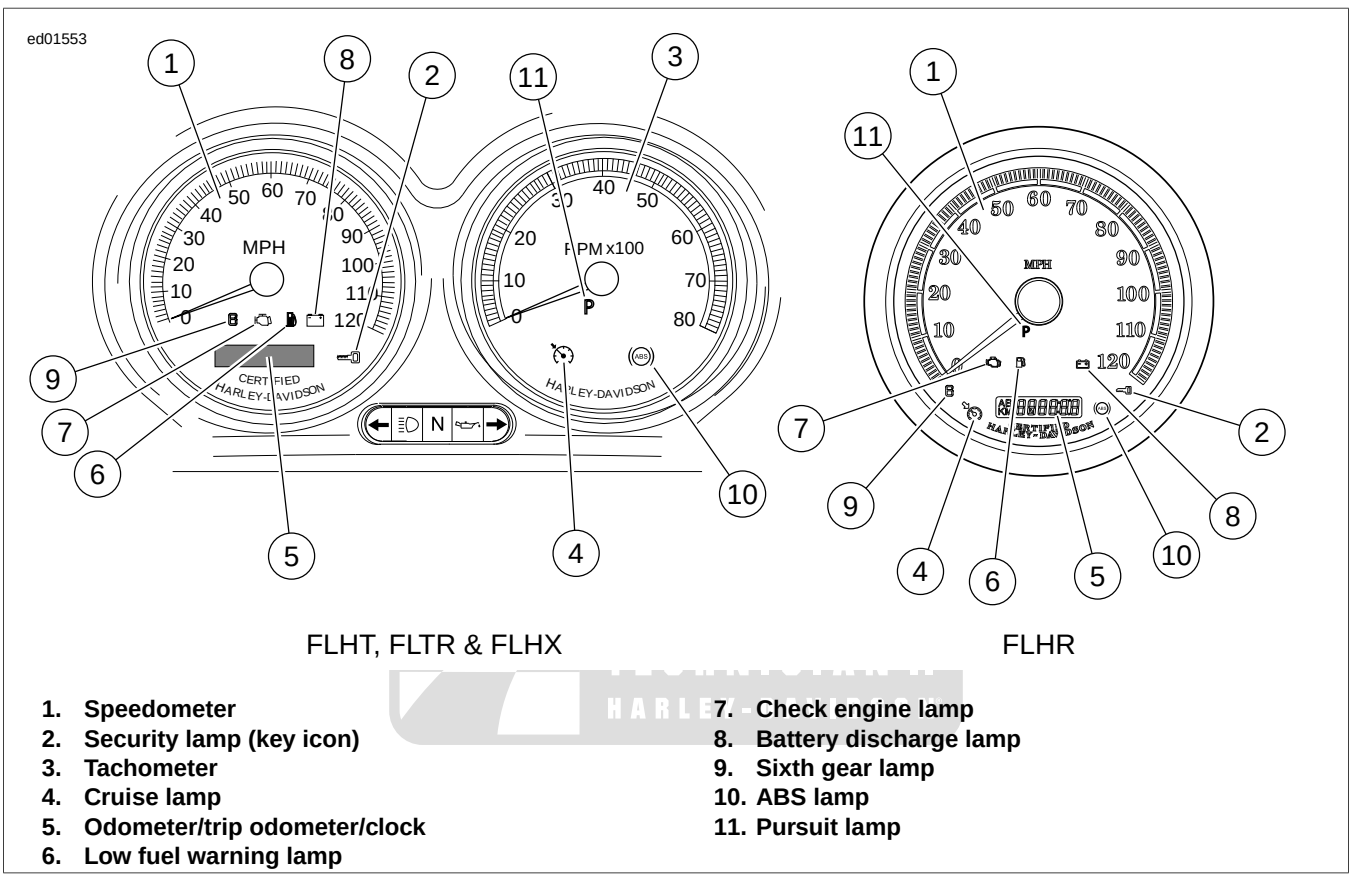
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ABS INDICATOR DIAGNOSTICS 6.5

ABS INDICATOR ALWAYS ON OR INOPERATIVE

Circuit Description

See Figure 6-10. The instrument illuminates the ABS indicator by supplying ground to the lamp. The ABS module sends a serial data message to the instrument in order to command the indicator on or off.



1. **Speedometer**
2. **Security lamp (key icon)**
3. **Tachometer**
4. **Cruise lamp**
5. **Odometer/trip odometer/clock**
6. **Low fuel warning lamp**
7. **Check engine lamp**
8. **Battery discharge lamp**
9. **Sixth gear lamp**
10. **ABS lamp**
11. **Pursuit lamp**

Figure 6-10. Instrument

Diagnostic Tips

The malfunction must be present during diagnosis in order to prevent unnecessary parts replacement.

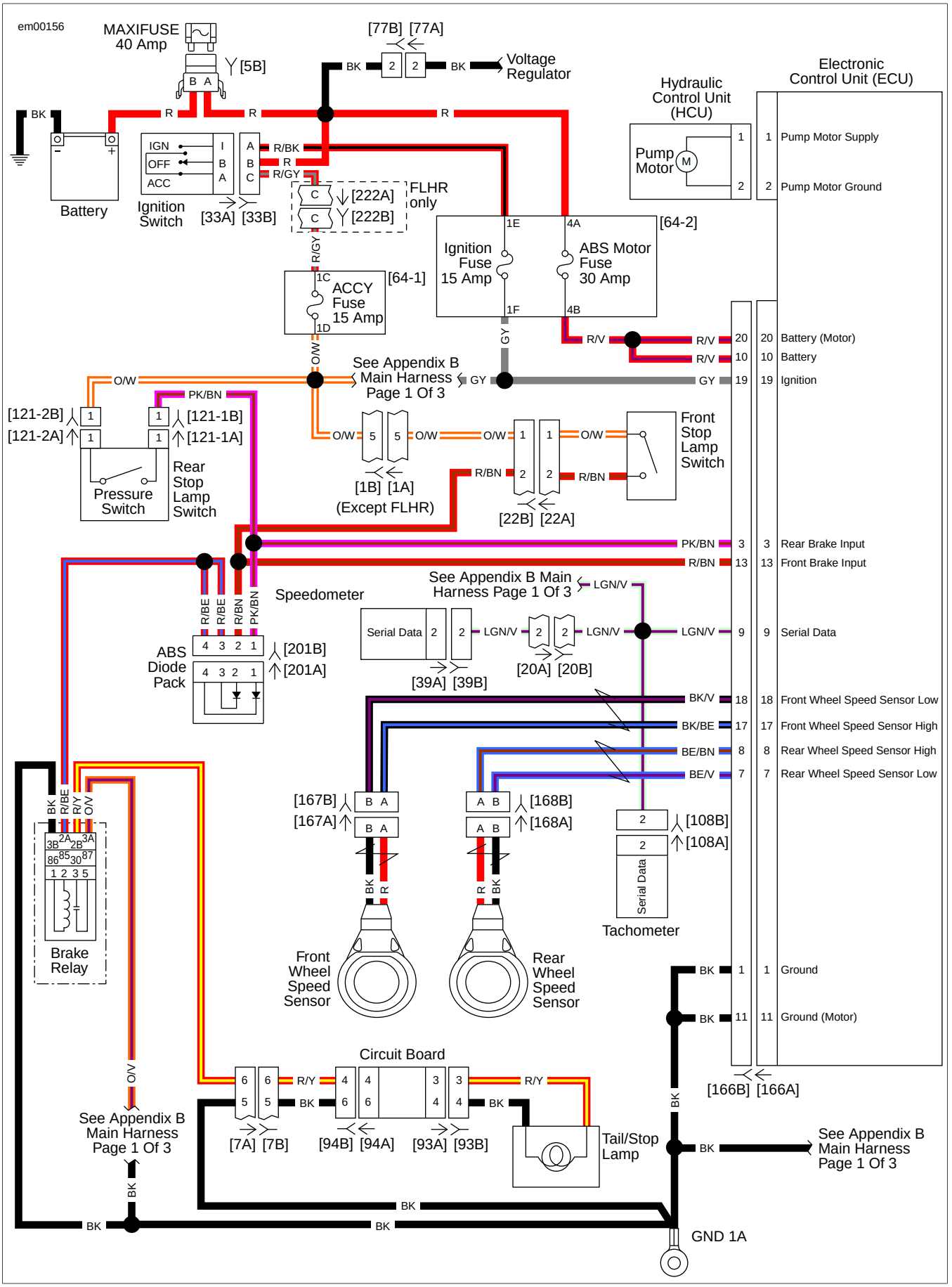
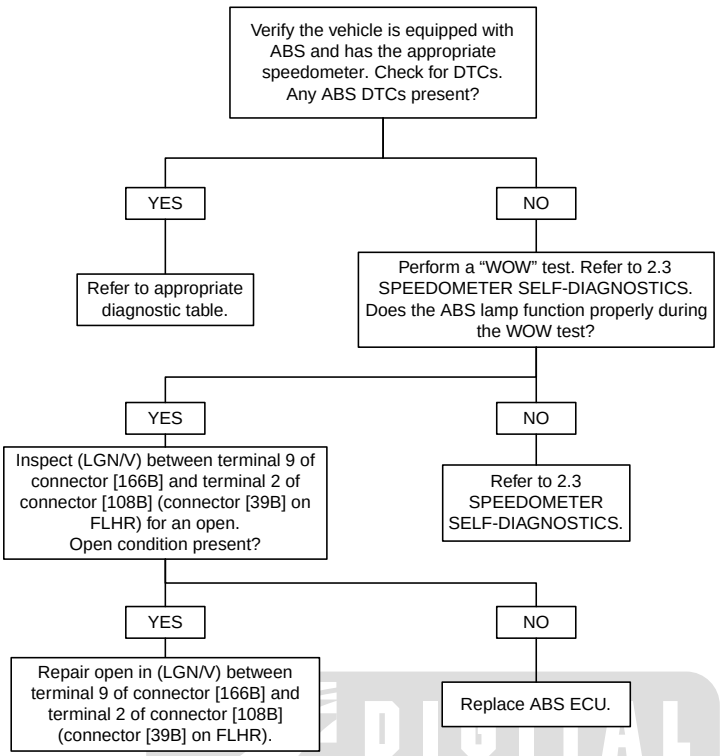


Figure 6-11. ABS Schematic

Table 6-3. Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	FLHT/C/U/X - inner fairing - right radio support bracket FLTR - inner fairing right side below radio
[5]	MAXIFUSE	2-place Packard	Under left side cover
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[20]	Console harness	16-place Molex	FLHR - under seat
[22]	Interconnect to right handlebar switches	12-place Molex (black)	FLHT/C/U/X - inner fairing - right fairing support brace FLTR - inner fairing left radio bracket FLHR - inside headlamp nacelle
[33]	Ignition switch	3-place Packard	FLHT/C/U/X, FLTR - front of ignition switch housing FLHR - Under console
[39]	Speedometer	12-place Packard	FLHT/C/U - inner fairing (back of speedometer) FLTR - under bezel (back of speedometer) FLHR - under console (back of speedometer)
[64-1]	Fuse block	Packard	Under left side cover
[64-2]	Fuse block	Packard	Under left side cover
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)
[93]	Tail/stop lamp	4-place Multilock	Circuit board under tail lamp assembly
[94]	Rear fender light harness to circuit board	6-place Multilock	Circuit board under tail lamp assembly
[108]	Tachometer	12-place Packard	FLHT/C/U/X - inner fairing (back of tachometer) FLTR - under bezel (back of tachometer)
[121]	Rear brake light switch	Spade terminals	Bottom of rear frame downtube (right side)
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Packard	Above left side lower fork bracket
[168]	Rear wheel speed sensor	2-place Packard	Under right side cover, rear of ABS module mount
[201]	ABS diode pack	4-place Deutsch	Under left side cover
[222]	Main to ignition harness	4-place Packard	FLHR - rear of fuel tank

ABS Indicator Always On or Inoperative



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DTC C0562 6.6

DTC C0562: DEVICE VOLTAGE LOW

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The ABS module monitors the voltage level available for system operation. A low voltage condition prevents the system from operating properly.

Conditions for Running the DTC

Ignition voltage is greater than 6.5 Volts and the vehicle speed is above 5 MPH (8 km/h).

Conditions for Setting the DTC

One of the following conditions exists for at least 0.72 seconds:

- during initialization or when the system is active the system voltage is below 9.0 Volts.
- the system voltage drops below 10.5 Volts with the system enabled and the pump not running.
- the ignition voltage is below 8.7 Volts.
- battery voltage is below 8.7 Volts with vehicle speed above 5 MPH (8 km/h) and engine speed above 500 RPM.

Action Taken When the DTC Sets

- ABS is disabled.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ABS module automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- charging system malfunction.
- excessive battery draw and/or extended idling in heavy traffic.
- a weak battery.
- a faulty system ground.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. The ignition circuit between wire harness connector [166B] and ABS connector [166A] consists of all the circuitry back to and including the ignition switch.

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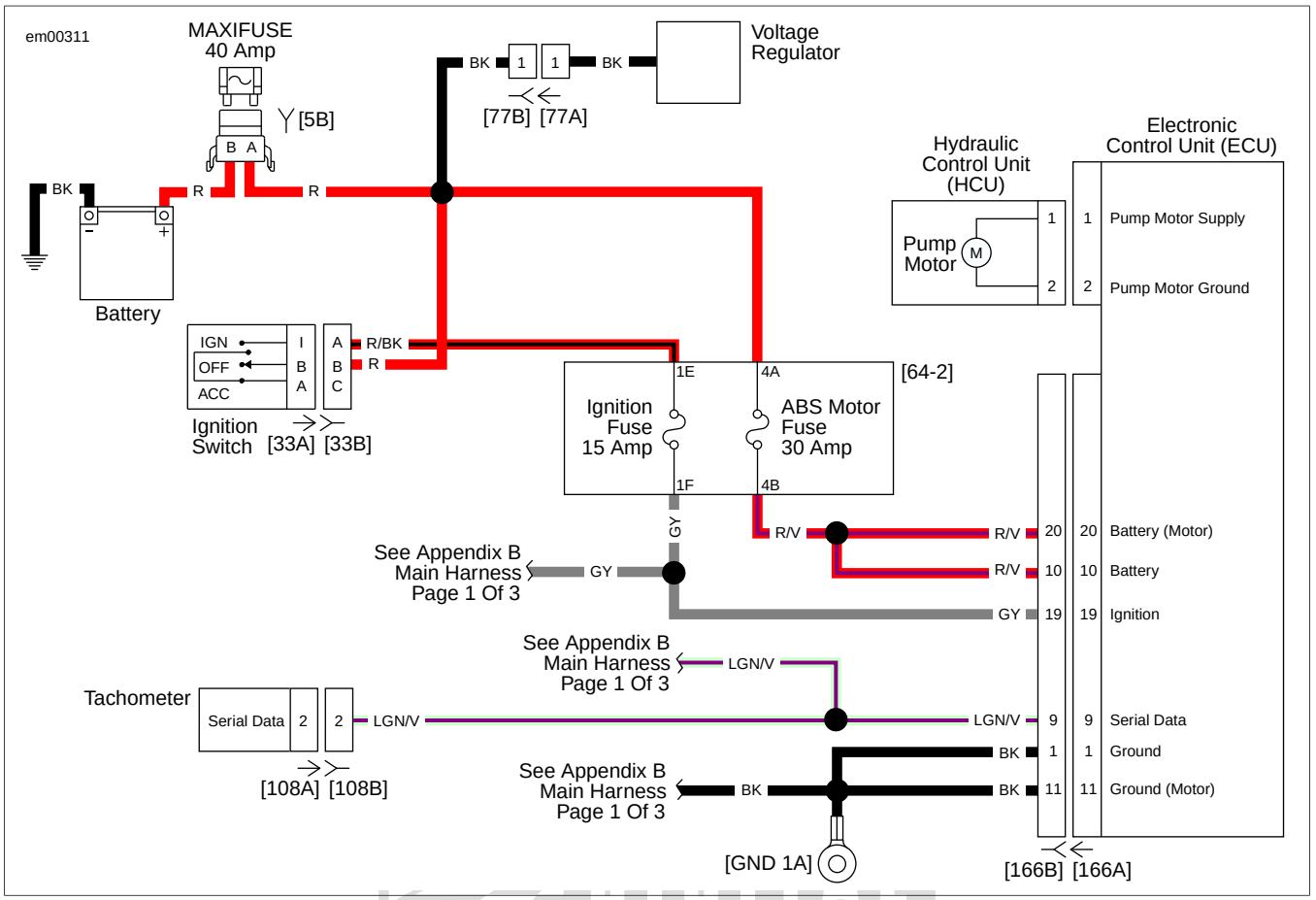
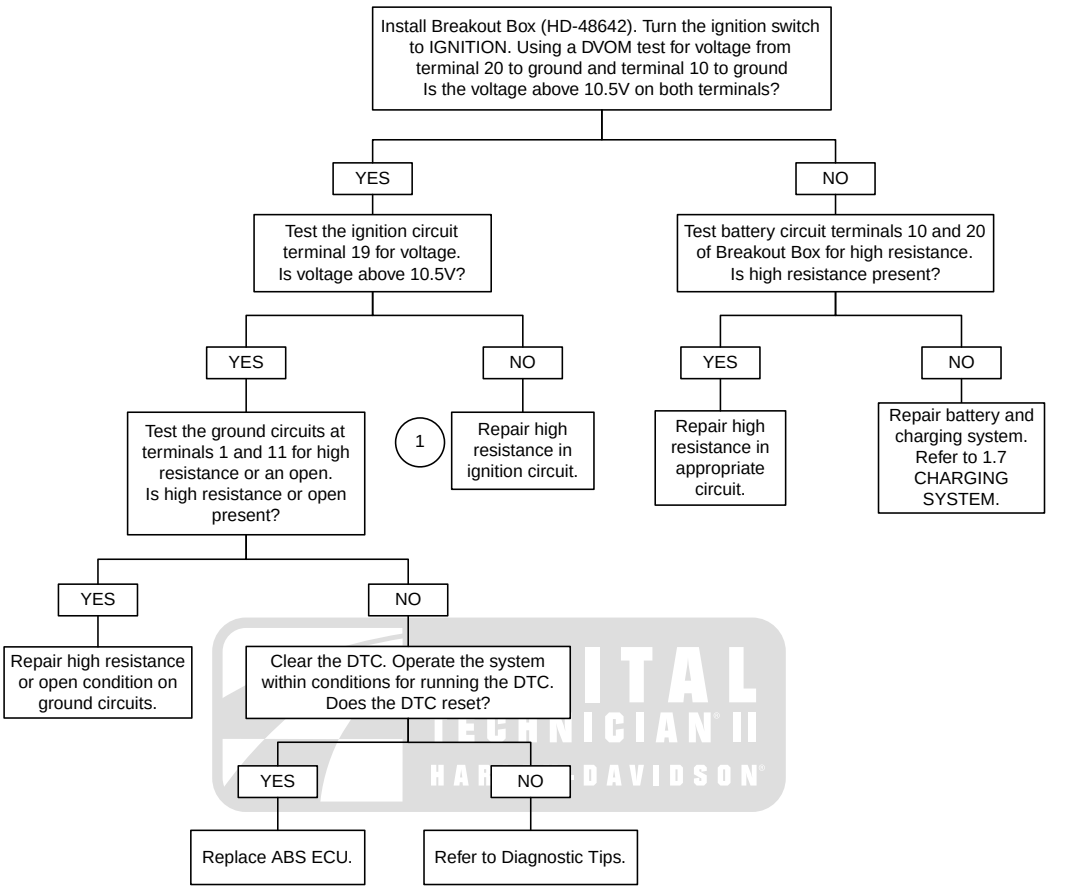


Figure 6-12. ABS Power and Ground Schematic

Table 6-4. Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[5]	MAXIFUSE	2-place Packard	Under left side cover
[33]	Ignition switch	3-place Packard	Front of ignition switch housing FLHR - under console
[64-2]	Fuse block	Packard	Under left side cover
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)
[108]	Tachometer	12-place Packard	FLHT/C/U/X - inner fairing (back of tachometer) FLTR - instrument bezel (under tachometer)
[166]	ABS module	20-place Molex	Under right side cover

DTC C0562



Clear DTCs using speedometer self-diagnostics.
See 2.3 SPEEDOMETER SELF-DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

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DTC C0563 6.7

DTC C0563: DEVICE VOLTAGE HIGH

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The ABS module monitors the system voltage level. If the voltage level is too high, damage may result to the system. When the ABS module detects a high voltage condition, it disables the ABS.

Conditions for Running the DTC

Ignition voltage is greater than 6.5 Volts.

Conditions for Setting the DTC

One of the following conditions exists for at least 0.72 seconds:

- when the system is active the system voltage is above 18.0 Volts.
- ignition voltage is above 18.0 Volts.

Action Taken When the DTC Sets

- ABS is disabled.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ABS module automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

This fault could be caused by an overcharging condition with either the vehicle's charging system or an external charging system.

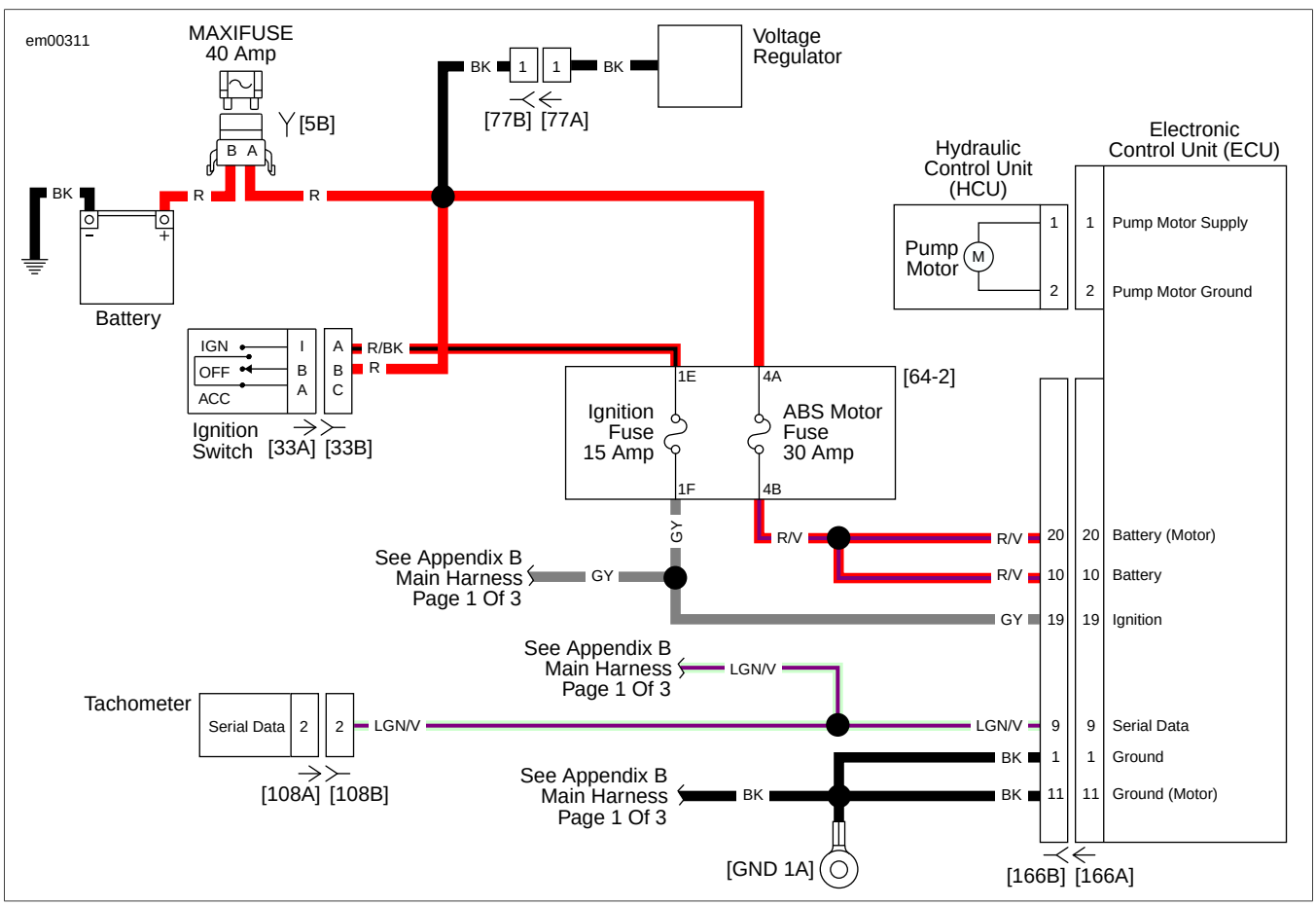


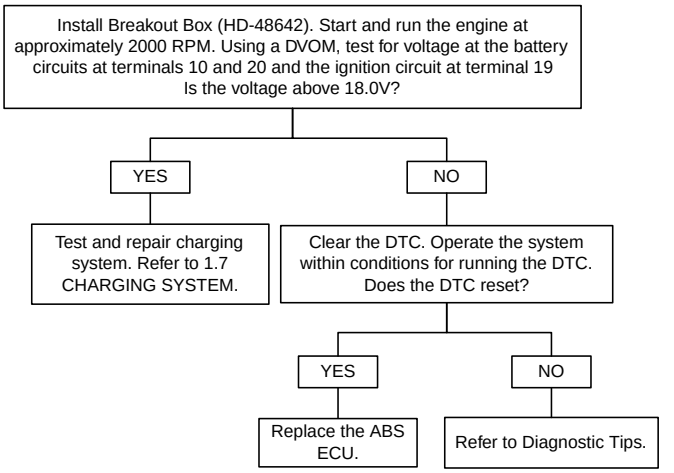
Figure 6-13. ABS Power and Ground Schematic

Table 6-5. Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[5]	MAXIFUSE	2-place Packard	Under left side cover
[33]	Ignition switch	3-place Packard	Front of ignition switch housing FLHR - under console
[64-2]	Fuse block	Packard	Under left side cover
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)
[108]	Tachometer	12-place Packard	FLHT/C/U/X - inner fairing (back of tachometer) FLTR - instrument bezel (under tachometer)
[166]	ABS module	20-place Molex	Under right side cover

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DTC C0563



Clear DTCs using speedometer self-diagnostics.
See 6.2 SPEEDOMETER SELF-DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

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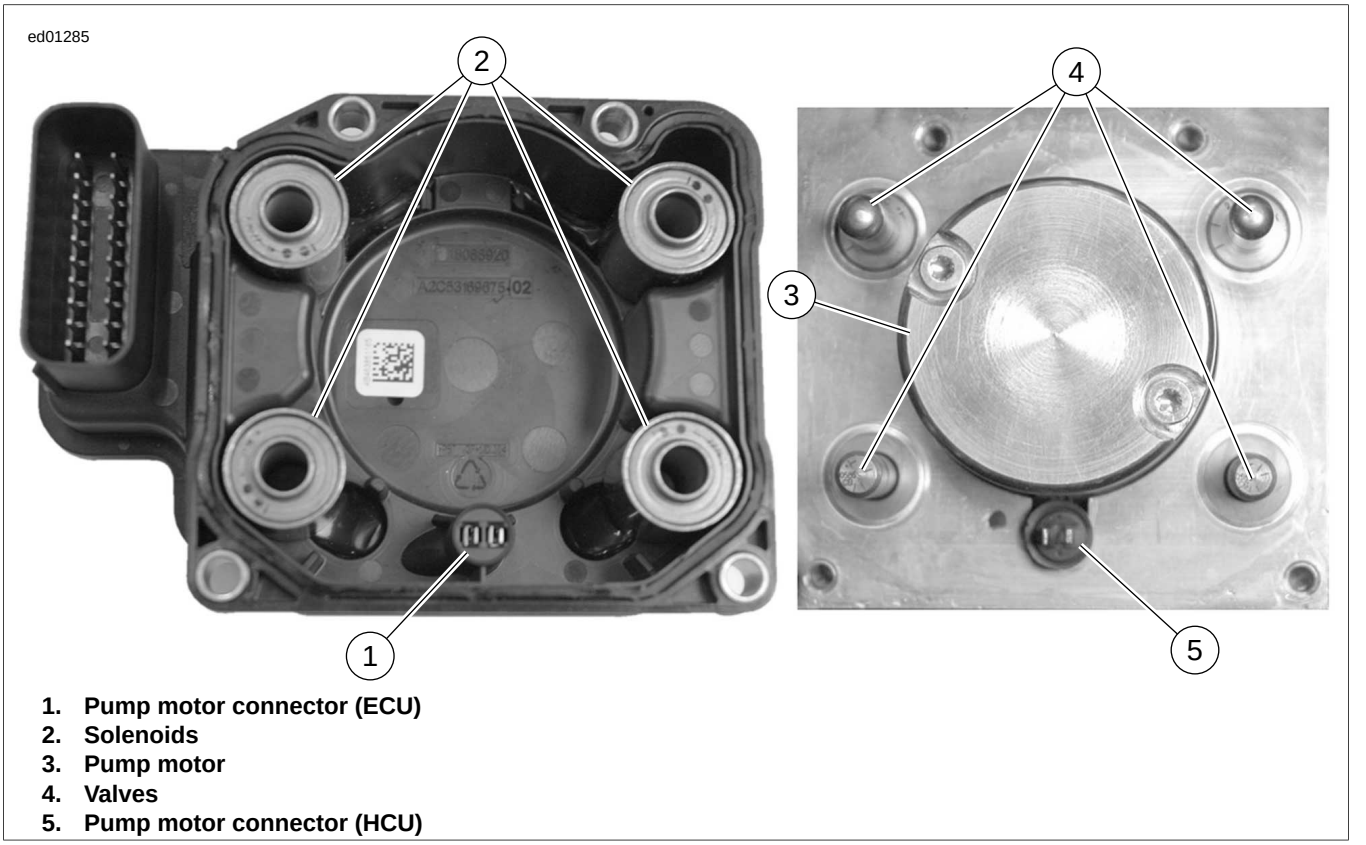
DTC C1017 6.8

DTC C1017: PUMP MOTOR POWER CIRCUIT OPEN FAULT

PART NUMBER	TOOL NAME
HD-48642	BREAKOUT BOX
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

See Figure 6-14. The ABS module monitors the internal relay for the pump motor along with the power circuit going to it.



1. **Pump motor connector (ECU)**
2. **Solenoids**
3. **Pump motor**
4. **Valves**
5. **Pump motor connector (HCU)**

Figure 6-14. ECU and HCU Pump Motor Connectors

Conditions for Running the DTC

- The system is enabled and the system voltage is above 10.5 Volts.
- The ignition voltage is between 8.7-18.0 Volts.

Conditions for Setting the DTC

The DTC sets if any of the following conditions exist:

- The voltage across the pump is below 8.0 Volts for 0.2 seconds.
- The battery voltage to the pump is less than 8.84 Volts.
- The pump relay coil is not shorted to battery or open.

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ABS module automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

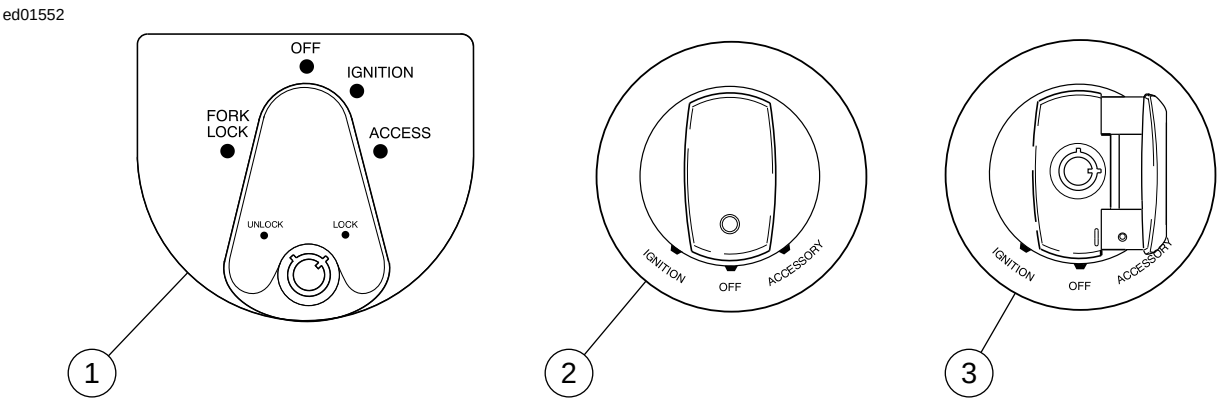
The following conditions are possible causes for this fault:

- high resistance or open pump motor battery circuit.
- internal ECU pump relay fault.
- battery or charging malfunction.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-48642) between wire harness connector [166B] and ABS connector [166A].



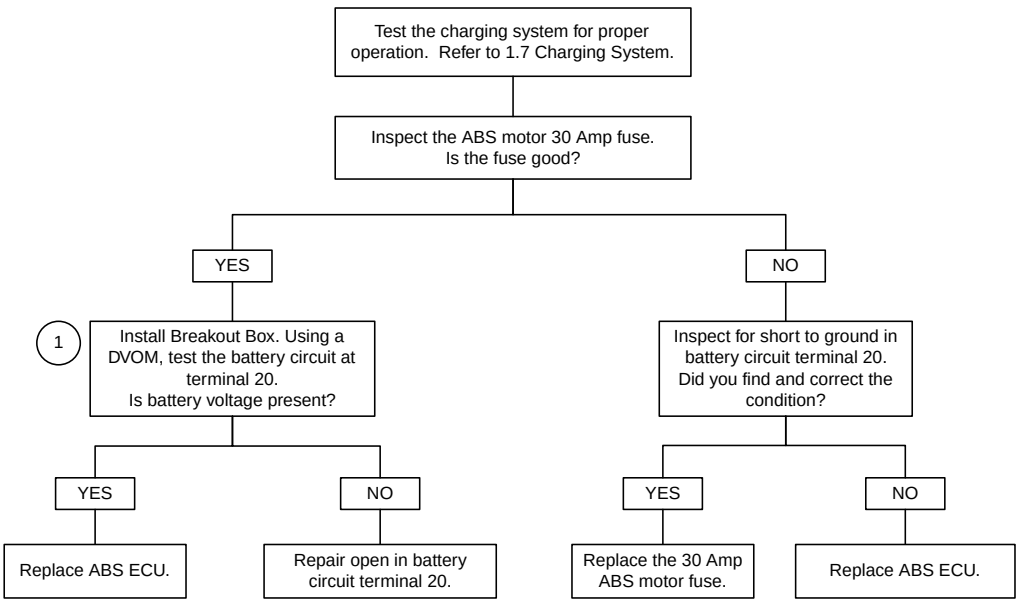
1. **All except FLHR models**
2. **All FLHR models (cover shown closed)**
3. **All FLHR models (cover shown open)**

Figure 6-15. Ignition Switch: Touring Models

Table 6-6. Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[5]	MAXIFUSE	2-place Packard	Under left side cover
[33]	Ignition switch	3-place Packard	Front of ignition switch housing FLHR - under console
[64-2]	Fuse block	Packard	Under left side cover
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)
[108]	Tachometer	12-place Packard	FLHT/C/U/X - inner fairing (back of tachometer) FLTR - instrument bezel (under tachometer)
[166]	ABS module	20-place Molex	Under right side cover

DTC C1017



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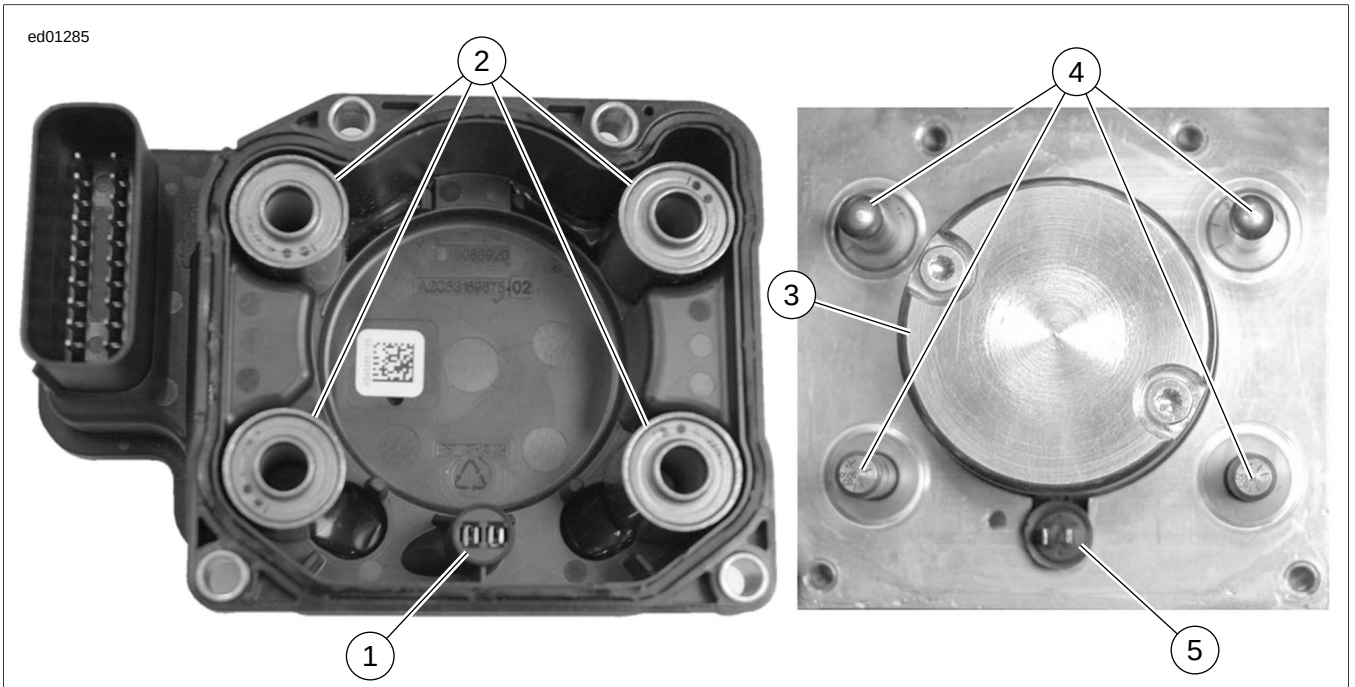
DTC C1018 6.9

DTC C1018: PUMP MOTOR GROUND HIGH RESISTANCE FAULT

PART NUMBER	TOOL NAME
HD-48642	BREAKOUT BOX
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

See Figure 6-16. The ABS module monitors the internal pump motor and the circuit supplying ground to the pump motor.



1. **Pump motor connector (ECU)**
2. **Solenoids**
3. **Pump motor**
4. **Valves**
5. **Pump motor connector (HCU)**

Figure 6-16. ECU and HCU Pump Motor Connectors

Conditions for Running the DTC

- ignition voltage is between 8.7-18.0 Volts.
- system is enabled.

Conditions for Setting the DTC

The DTC sets if the following conditions exist when the pump motor is commanded off.

- system voltage is between 8.0-18.0 Volts.
- voltage at the low side of the pump is greater than 1.7 Volts.

The DTC sets if the following conditions exist when the pump is commanded on.

- system voltage is between 10.0-18.0 Volts.
- voltage across the pump motor is less than 8.4 Volts.
- voltage at the high side of the pump motor is greater than 8.84 Volts.

Action Taken When the DTC Sets

- ABS is disabled.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ABS module automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- pump motor ground circuit has high resistance or open.
- battery or charging malfunction.

Diagnostic Test

1. Disconnect ECU harness connector [166B] from the ECU connector [166A], and connect BREAKOUT BOX (Part No. HD-48642).
2. With a DVOM, check for continuity to ground on terminal 11.

- If continuity is present, replace ABS ECU.
- If continuity is not present, locate and repair open circuit between terminal 11 and ground.

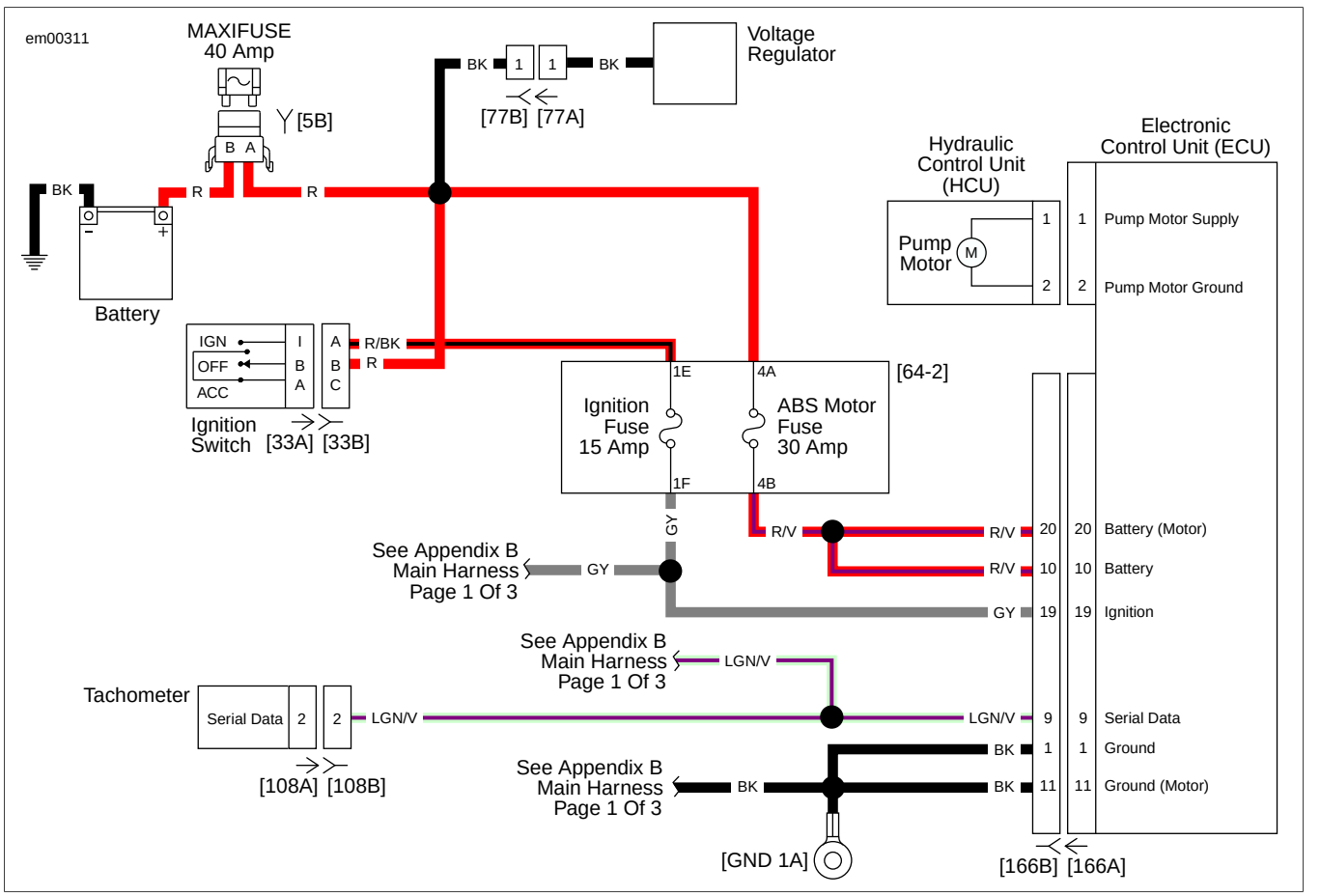


Figure 6-17. ABS Power and Ground Schematic

Table 6-7. Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[5]	MAXIFUSE	2-place Packard	Under left side cover
[33]	Ignition switch	3-place Packard	Front of ignition switch housing FLHR - under console
[64-2]	Fuse block	Packard	Under left side cover
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)

Table 6-7. Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[108]	Tachometer	12-place Packard	FLHT/C/U/X - inner fairing (back of tachometer) FLTR - instrument bezel (under tachometer)
[166]	ABS module	20-place Molex	Under right side cover

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC C1021, C1023 6.10

DTC C1021, C1023: WHEEL SPEED SENSOR EQUALS ZERO (FRONT OR REAR)

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The active wheel speed sensor is supplied system voltage from the ABS module. The sensor then returns a 7 mA or 14 mA signal back to the ABS module.

Conditions for Running the DTC

- ignition voltage is greater than 6.5 Volts.
- the ABS is inactive.
- the brake is not pressed.
- there are no wheel speed sensor circuit malfunctions.
- vehicle must be driven above 10 MPH (16 km/h) for 20 seconds without a brake input.

Conditions for Setting the DTC

DTC C1021 sets if the following conditions exist for over 20 seconds:

- the front wheel speed equals 0 MPH (0 km/h).
- the rear wheel speed is greater than 10 MPH (16 km/h).
- the difference between the two wheel speeds is greater than 11 MPH (18 km/h).

DTC C1023 sets if the following conditions exist for over 20 seconds.

- the rear wheel speed equals 0 MPH (0 km/h).
- the front wheel speed is greater than 10 MPH (16 km/h).
- the difference between the two wheel speeds is greater than 11 MPH (18 km/h).

Action Taken When the DTC Sets

- ABS module disables the ABS.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ABS module automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- internal sensor fault.
- spinning up the rear wheel over 10 MPH (16 km/h) with the vehicle in a stationary position for an extended period of time (dynamometer).

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

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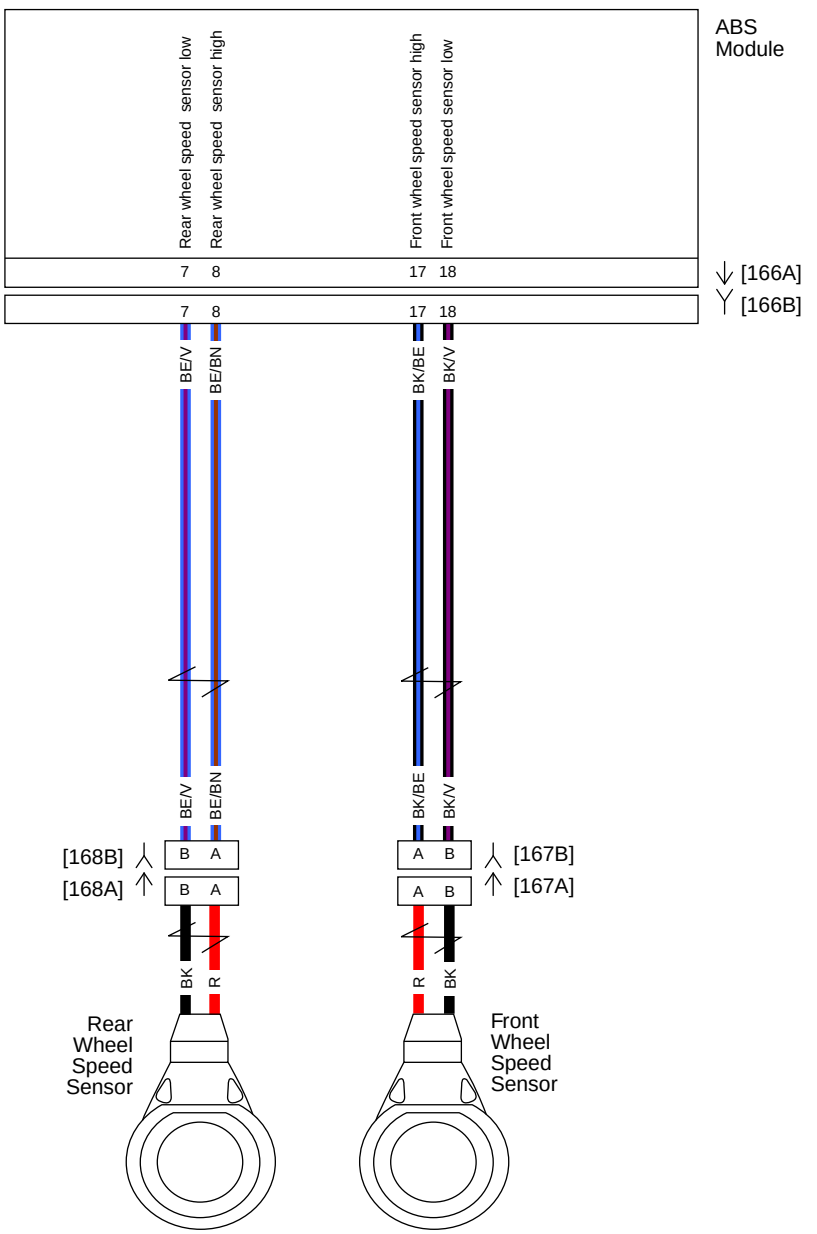


Figure 6-18. Wheel Speed Sensor Schematic

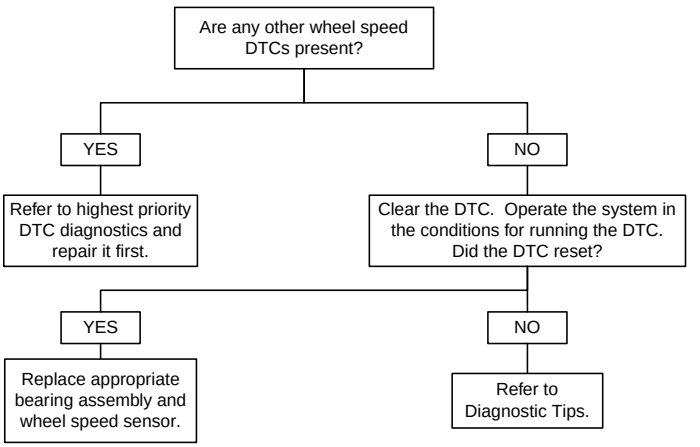
Table 6-8. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Packard	Above lower fork bracket (left side)
[168]	Rear wheel speed sensor	2-place Packard	Under right side cover, rear of ABS mount

DTCs C1021 (Front) and C1023 (Rear)

NOTE

This code may occur if the vehicle experiences an abnormal amount of wheel slippage due to slippery conditions under launch or intentional front or rear wheel spin (dynamometer testing).





Clear DTCs using speedometer self-diagnostics.
See 6.2 SPEEDOMETER SELF-DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

fc02248_en

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC C1025, C1027, C1206, C1208 6.11

DTC C1025, C1027, C1206, C1208: WHEEL SPEED SIGNAL INTERMITTENT OR FREQUENCY OUT OF RANGE

PART NUMBER	TOOL NAME
HD-48642	BREAKOUT BOX
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The active wheel speed sensor is supplied system voltage from the ABS module. The sensor then returns a 7 mA or 14 mA signal back to the ABS module.

Conditions for Running the DTC

- ignition voltage is greater than 6.5 Volts.
- the brake is not pressed.
- there are no front or rear wheel speed sensor circuit malfunctions.

Conditions for Setting the DTC

The DTC sets if the following conditions exist.

- the ABS module detects a rapid variation in the wheel speed. The wheel speed changes by 12 MPH (20 km/h) or more in 0.01 second. The change must occur three times with no more than 0.2 seconds between occurrences.
- the frequency of the wheel speed input goes above 2.5 kHz for 20 milliseconds.

Action Taken When the DTC Sets

- ABS module disables the ABS.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ABS module automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- external or internal wheel speed circuit intermittent open.
- mismatched or improperly sized tires.
- electrical noise on the wheel speed wires.
- worn suspension components.
- rough terrain.

If the fault only occurs in moist conditions (such as rain, snow, or vehicle wash) inspect the wheel speed sensor and wiring for signs of water intrusion.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. A possible cause of the DTC is electrical noise on the wheel speed sensor wire harness. Electrical noise could result from the wheel speed sensor wires being routed too close to high energy ignition system components, such as spark plug wires.
2. Connect BREAKOUT BOX (Part No. HD-48642) between wire harness connector [166B] and ABS connector [166A].

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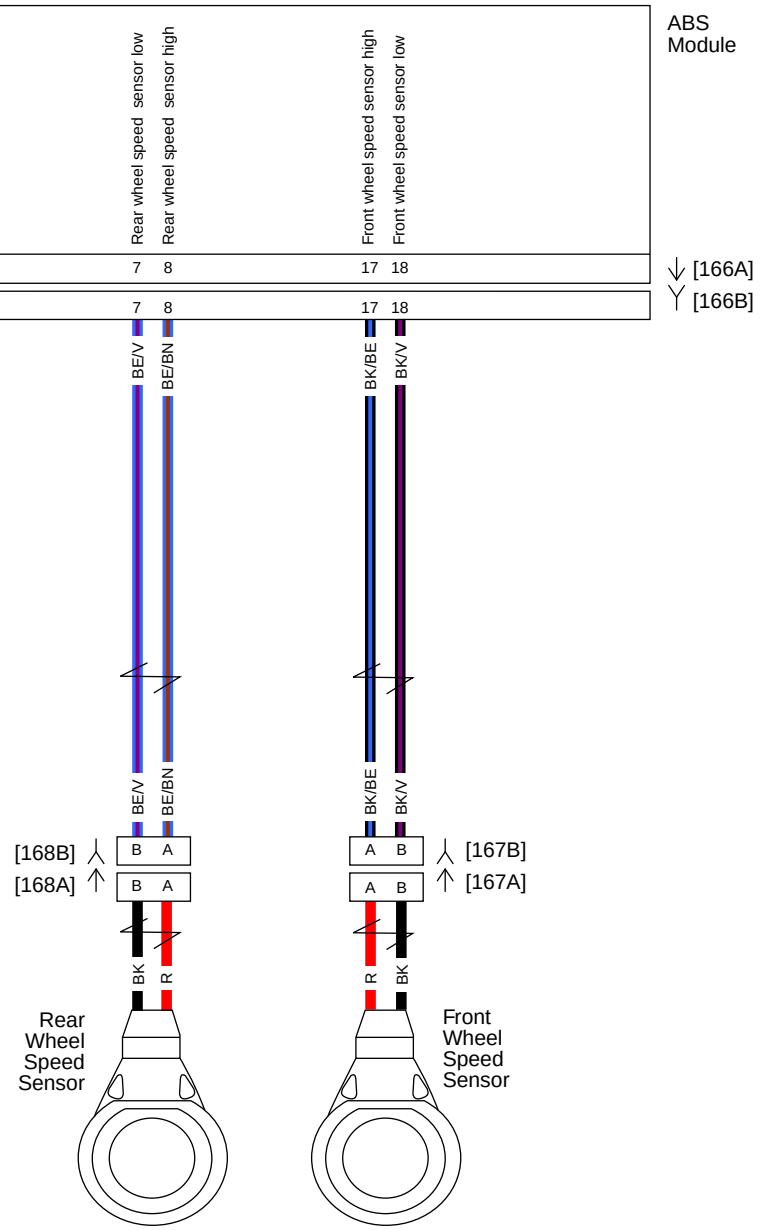
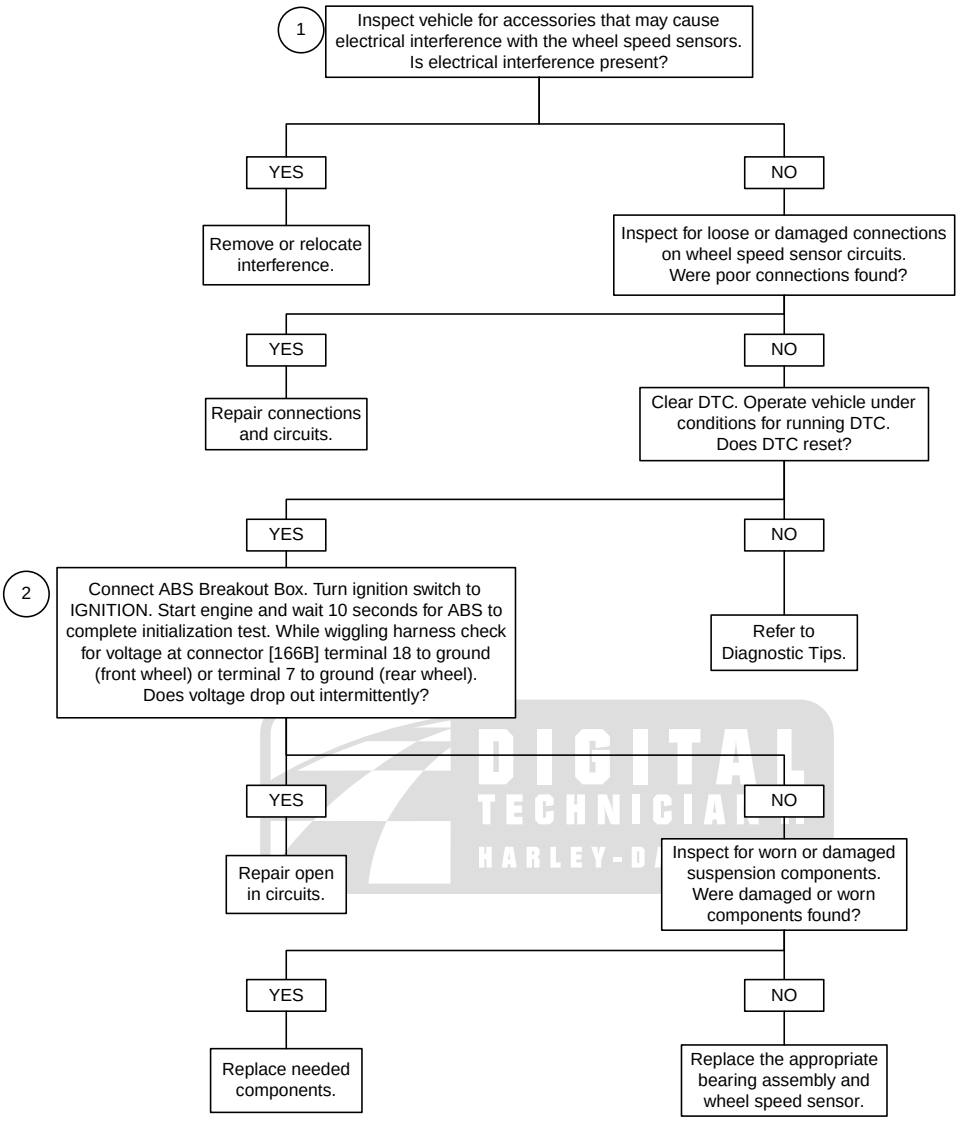


Figure 6-19. Wheel Speed Sensor Schematic

Table 6-9. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Packard	Above lower fork bracket (left side)
[168]	Rear wheel speed sensor	2-place Packard	Under right side cover, rear of ABS mount

DTCs C1025, C1027, C1206, and C1208,



Clear DTCs using speedometer self-diagnostics.
See 6.2 SPEEDOMETER SELF-DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

fc02249_en

DTC C1032, C1034 6.12

DTC C1032, C1034: WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED (FRONT OR REAR)

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48642	BREAKOUT BOX
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The active wheel speed sensor is supplied system voltage from the ABS module. The sensor then returns a 7 mA or 14 mA signal back to the ABS module.

Conditions for Running the DTC

- ignition voltage is greater than 6.5 Volts.
- there are no front or rear wheel speed sensor circuit malfunctions.

Conditions for Setting the DTC

The DTC sets if the following conditions exist:

- short to ground on either the high or low side circuits of the front wheel speed sensor.
- open on either the high or low side circuits of the front wheel speed sensor.
- short to voltage on the low side causing the voltage to go above 0.79 Volts.
- wheel speed sensor open.

Action Taken When the DTC Sets

- ABS module disables the ABS.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ABS module automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- open in either of the front wheel speed sensor circuits.
- short to ground in either of the front wheel speed sensor wires.
- front wheel speed sensor open.
- front wheel speed circuit low shorted to battery.

If the fault only occurs in moist conditions (such as rain, snow, or vehicle wash) inspect the wheel speed sensor and wiring for signs of water intrusion.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) with gray male probes and patch cords.
2. Connect BREAKOUT BOX (Part No. HD-48642) between wire harness connector [166B] and ABS connector [166A].

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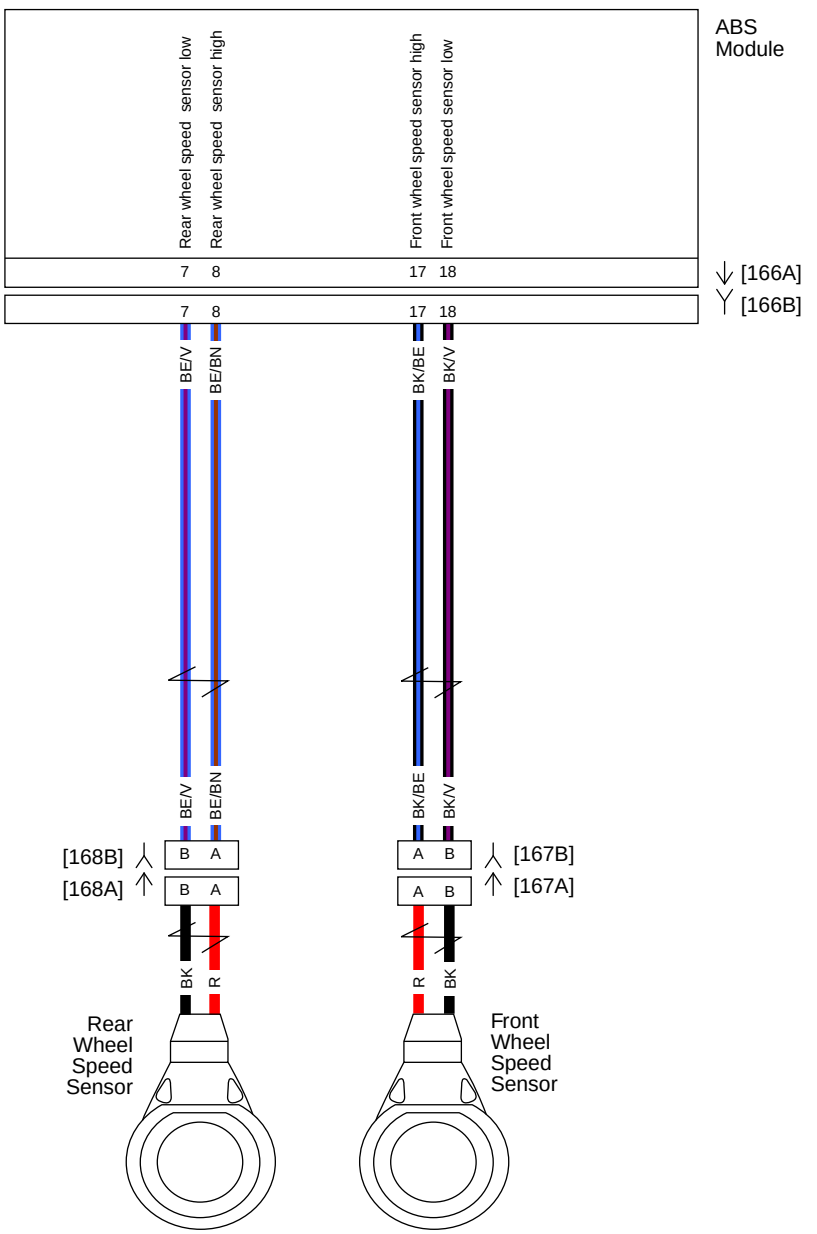
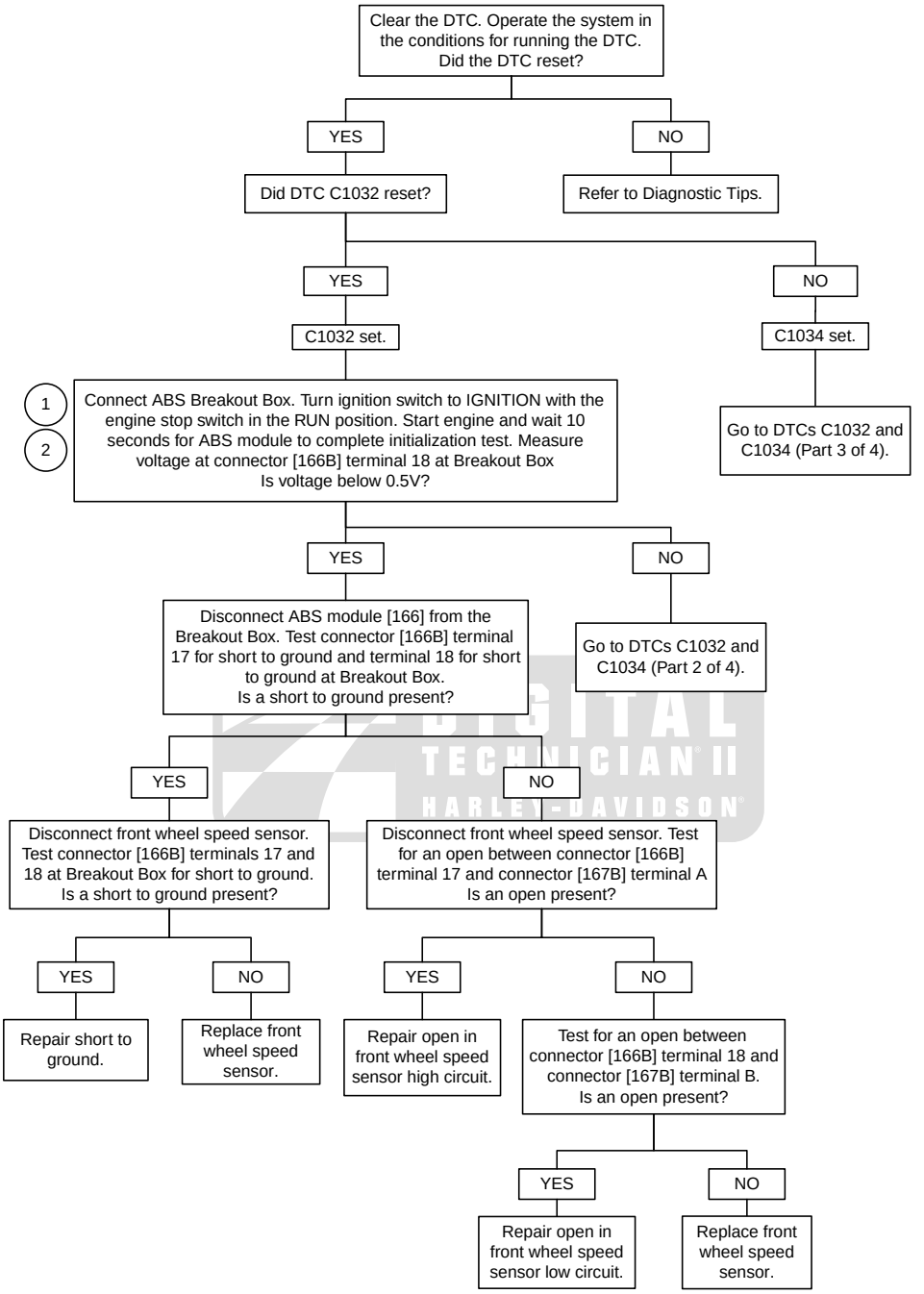


Figure 6-20. Wheel Speed Sensor Schematic

Table 6-10. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Packard	Above lower fork bracket (left side)
[168]	Rear wheel speed sensor	2-place Packard	Under right side cover, rear of ABS mount

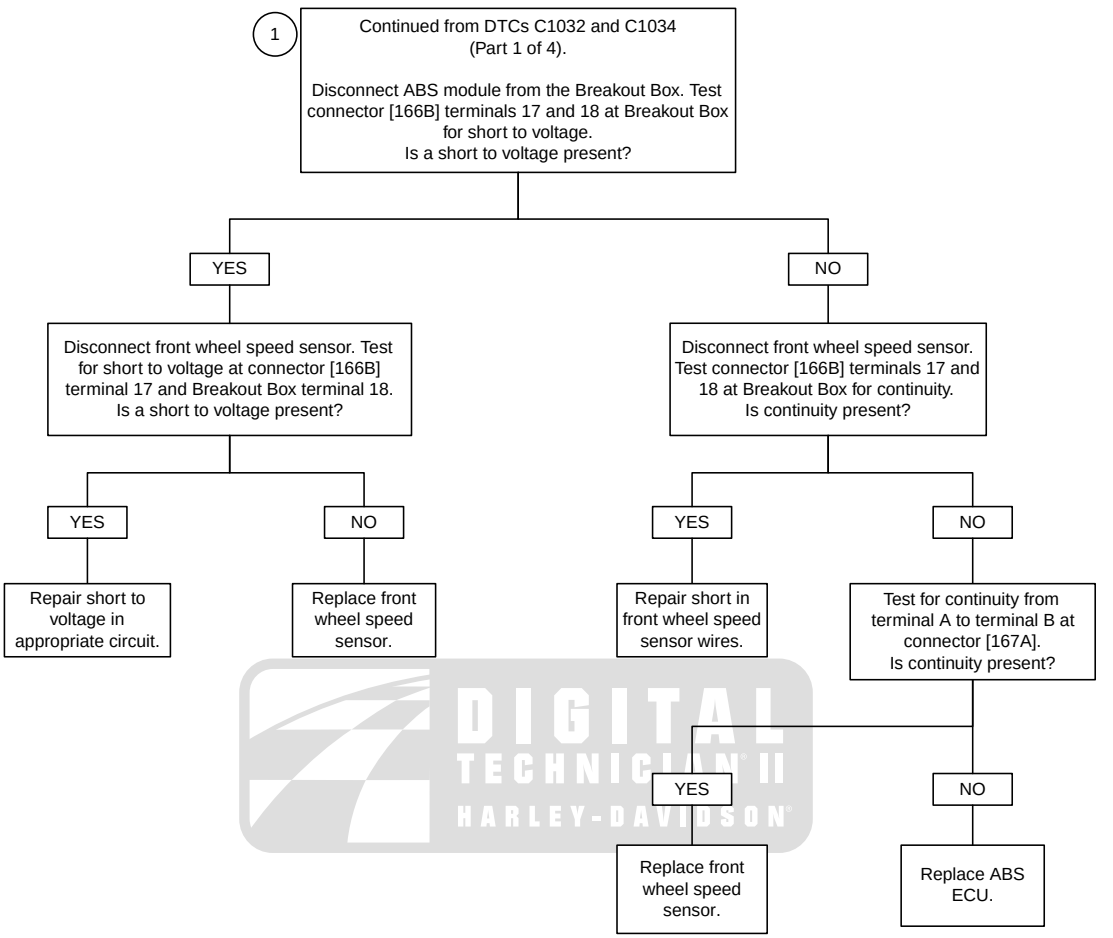
DTCs C1032 and C1034 (Part 1 of 4)



Clear DTCs using speedometer self-diagnostics. See 6.2 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

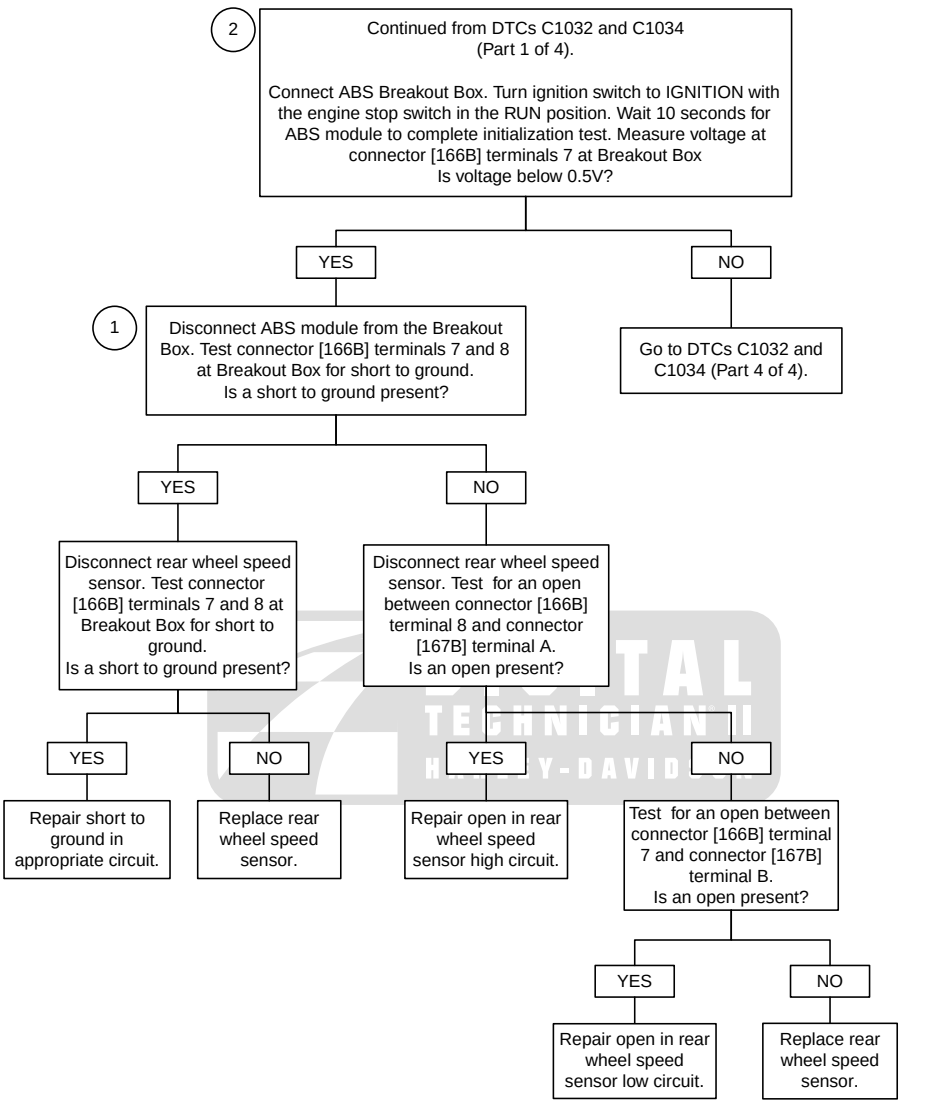
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DTCs C1032 and C1034 (Part 2 of 4)



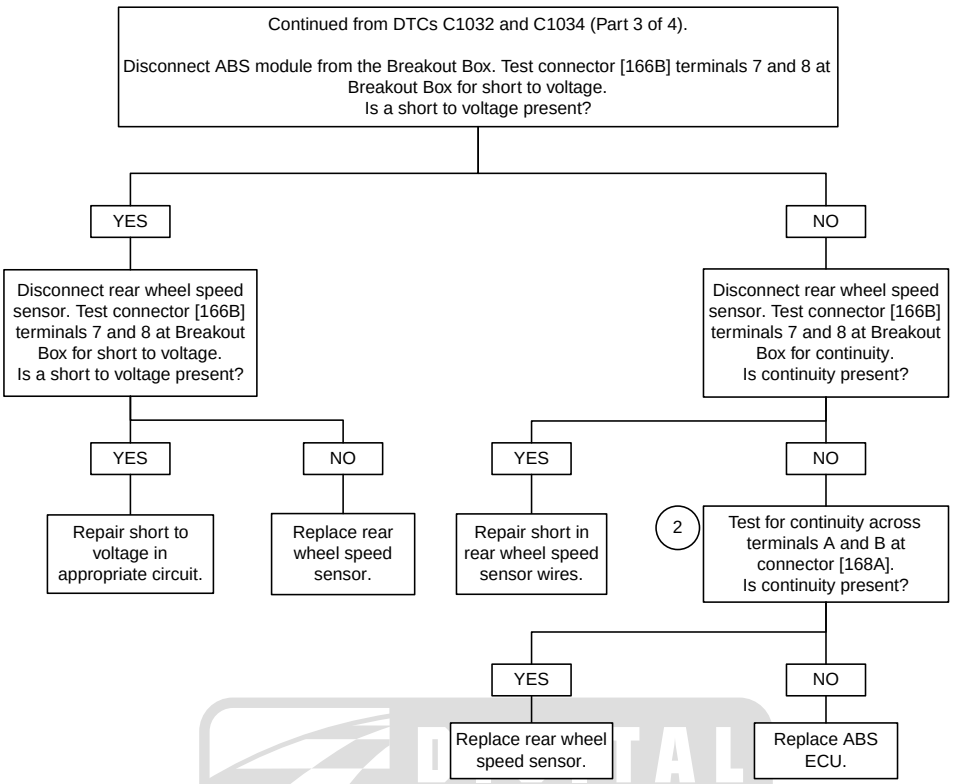
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DTCs C1032 and C1034 (Part 3 of 4)



fc02252_en

DTCs C1032 and C1034 (Part 4 of 4)



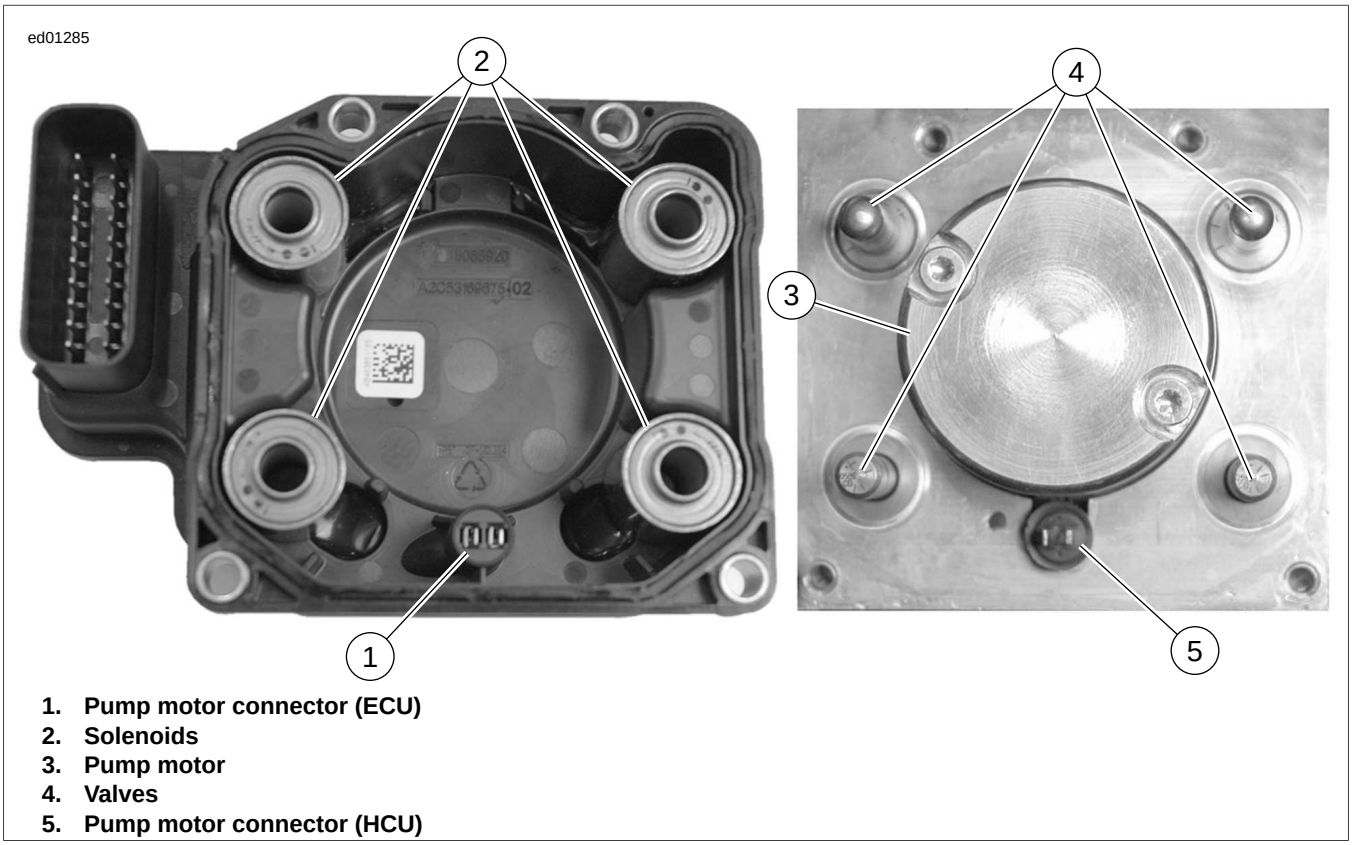
DTC C1042 6.13

DTC C1042: PUMP MOTOR OPEN

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

See Figure 6-21. The pump motor is located in the HCU portion of the ABS module. Power is supplied through an internal pump motor relay when the ignition is turned on. The ECU monitors pump motor feedback voltage after activation to detect a stalled or binding pump motor.



1. **Pump motor connector (ECU)**
2. **Solenoids**
3. **Pump motor**
4. **Valves**
5. **Pump motor connector (HCU)**

Figure 6-21. ECU and HCU Pump Motor Connectors

Conditions for Running the DTC

- ignition voltage is between 8.7-18.0 Volts.
- system voltage is between 8.0-18.0 Volts.
- system is enabled.
- the pump motor has been commanded off for 2.4 seconds.

Conditions for Setting the DTC

The DTC sets if the current did not exceed 15.6 Amps within 0.1 seconds of switching the pump motor on.

Action Taken When the DTC Sets

- ABS is disabled.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ECU automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- open or high resistance at the pump motor connector.
- open or high resistance in the pump motor windings.

Diagnostic Procedure

If this code exists, clear the code. Operate the system under conditions for running the DTC and if it resets replace the ABS Module.

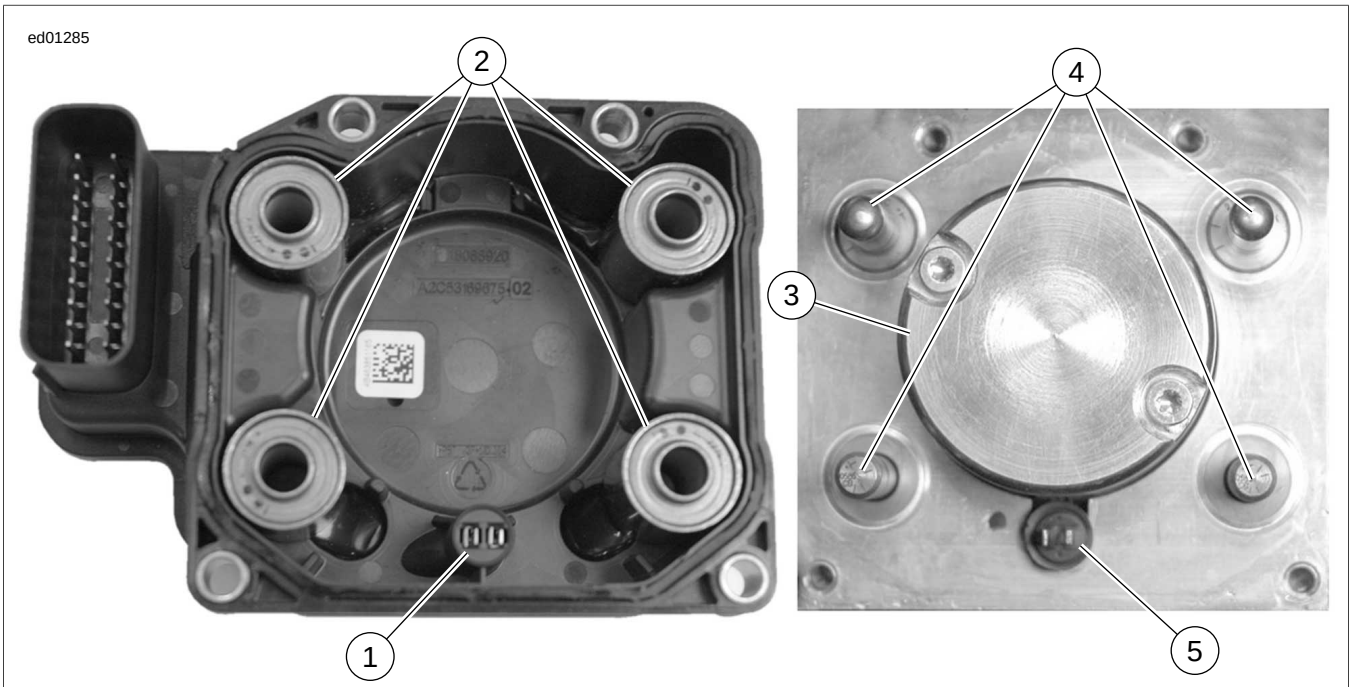
DTC C1043 6.14

DTC C1043: PUMP MOTOR STALLED

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

See Figure 6-22. The pump motor is located in the HCU portion of the ABS module. Power is supplied through an internal pump motor relay when the ignition is turned on. The ECU monitors pump motor feedback voltage after activation to detect a stalled or binding pump motor.



1. **Pump motor connector (ECU)**
2. **Solenoids**
3. **Pump motor**
4. **Valves**
5. **Pump motor connector (HCU)**

Figure 6-22. ECU and HCU Pump Motor Connectors

Conditions for Running the DTC

- ignition voltage is greater than 6.5 Volts.
- system voltage is between 8.0-18.0 Volts.
- system is enabled.
- pump motor has been commanded on for 0.3 seconds.

Conditions for Setting the DTC

The DTC sets if the following conditions exist:

- pump takes less than 0.03 seconds to spin down.
- current exceeds 15.6 amps within 0.33 mS of switching the pump motor on.

Action Taken When the DTC Sets

- ABS is disabled.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ECU automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- high side of the pump motor is shorted to ground.
- high or low resistance in the pump motor windings.
- pump motor is seized or requires excessive torque to spin.

Diagnostic Procedure

If this code exists, clear the code. Operate the system under conditions for running the code and if it resets replace the ABS module.

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DTC C1094 6.15

DTC C1094: FRONT BRAKE SWITCH ALWAYS ON

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The ABS module monitors the front brake switch input. When the brake lever is applied the ABS module receives voltage on the front brake switch circuit. The ABS module uses this signal to enhance ABS operation.

Conditions for Running the DTC

Ignition voltage is greater than 6.5 Volts.

Conditions for Setting the DTC

The DTC sets if all of the following conditions exist for two seconds:

- ECU sees a front brake input.
- vehicle speed exceeds 25 MPH (40 km/h).
- vehicle acceleration exceeds 5 MPH/second (8 km/h/second).

Action Taken When the DTC Sets

No action is taken when this code is set. The ABS indicator does not illuminate and the ABS is still active.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ECU automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- short to voltage between the front brake switch and the ECU.
- front brake switch stuck closed or applied during acceleration.
- internal front brake sensing malfunction.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) with gray male probes and patch cords.

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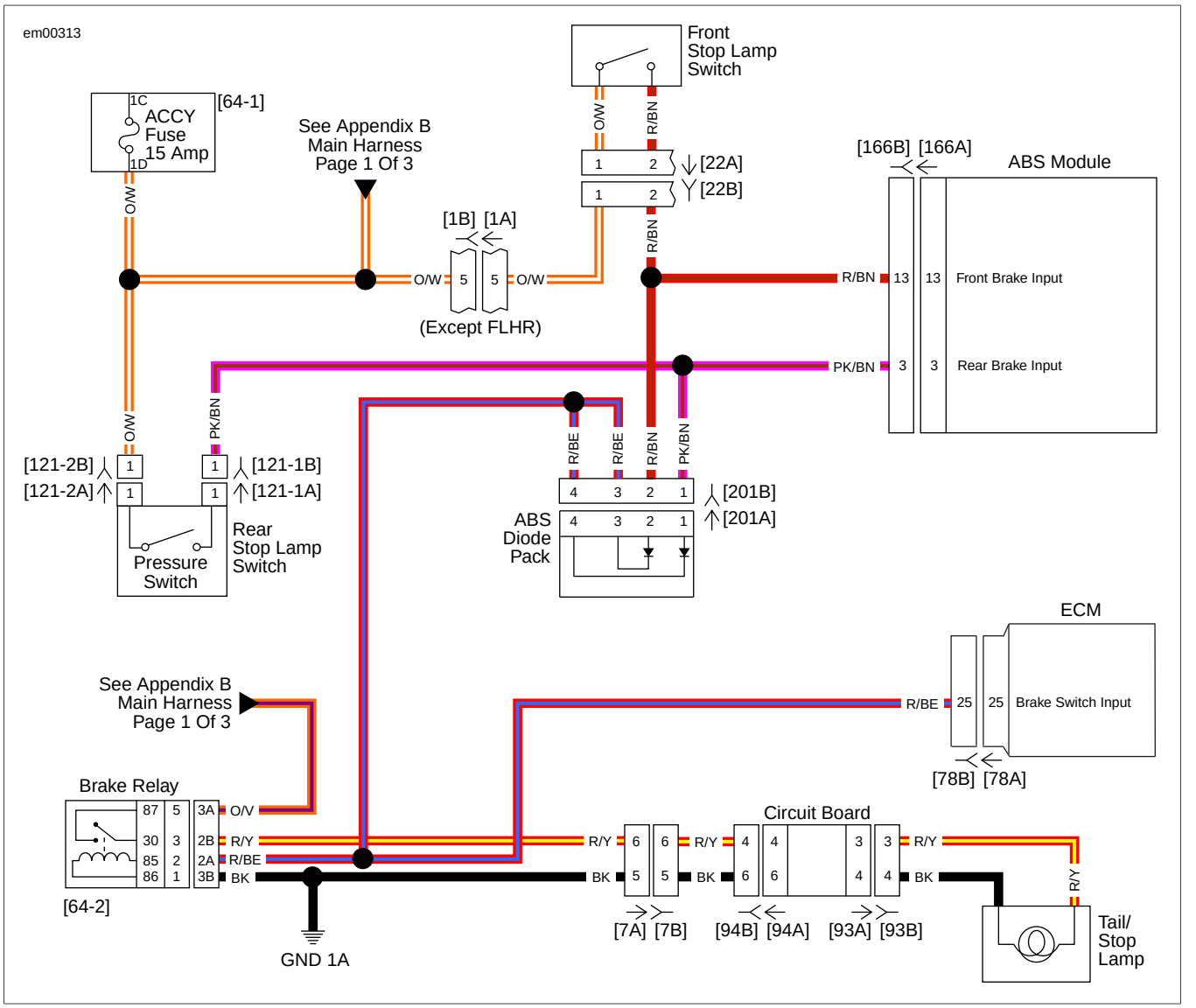


Figure 6-23. Brake Switches Schematic

Table 6-11. FLHX, FLHT/C/U Connector Locations

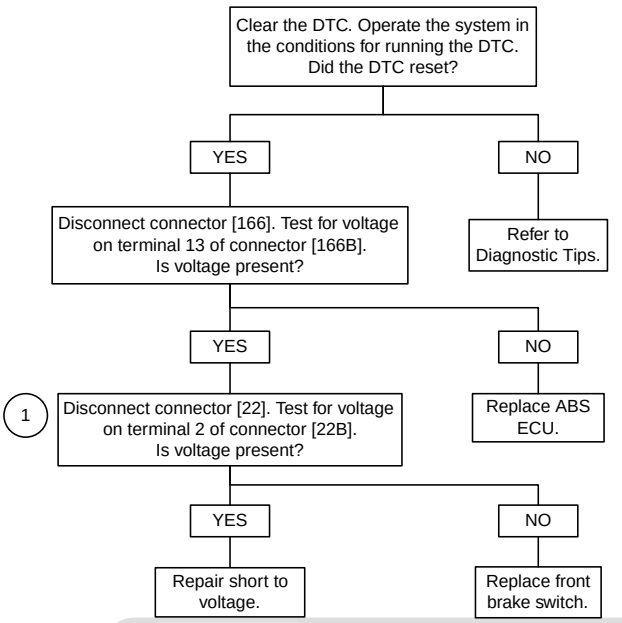
NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	FLHT/C/U/X - inner fairing - right radio support bracket FLTR - inner fairing right side below radio
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[22]	Interconnect to right handlebar switches	12-place Molex (black)	FLHT/C/U/X - inner fairing - right fairing support brace FLTR - inner fairing left side radio bracket
[64-1]	Fuse block	Packard	Under left side cover
[64-2]	Fuse block	Packard	Under left side cover
[78]	ECM	73-place Delphi	Under seat
[93]	Tail/Stop lamp	4-place Multilock	Circuit board under tail lamp assembly

Table 6-11. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[94]	Rear fender light harness to circuit board	6-place Multilock	Circuit board under tail lamp assembly
[121]	Rear brake switch	Spade terminals	Lower right side behind exhaust
[166]	ABS module	20-place	Behind right side cover
[201]	ABS diode pack	4-place	Behind left side cover

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DTC C1094



Clear DTCs using speedometer self-diagnostics.
See 6.2 SPEEDOMETER SELF-DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

fc02254_en

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DTC C1095 6.16

DTC C1095: FRONT BRAKE SWITCH OPEN

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The ABS module monitors the front brake switch input. When the brake lever is applied the ABS module receives voltage on the front brake switch circuit. The ABS module uses this signal to enhance ABS operation.

Conditions for Running the DTC

- ignition voltage is greater than 6.5 Volts.
- rear brake switch is not closed (brake applied).

Conditions for Setting the DTC

The DTC sets if all of the following conditions exist for 2 seconds:

- ABS module detects an open in the front brake input circuit.
- ABS module detects an open in the ground circuit to the front brake switch.

Action Taken When the DTC Sets

No action is taken when this code is set. The ABS indicator does not illuminate and the ABS is still active.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ECU automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- an open in the front brake input circuit.
- open coil in the brake lamp relay.
- ground path to the brake lamp is open.
- internal ABS module problem in the front brake circuitry.

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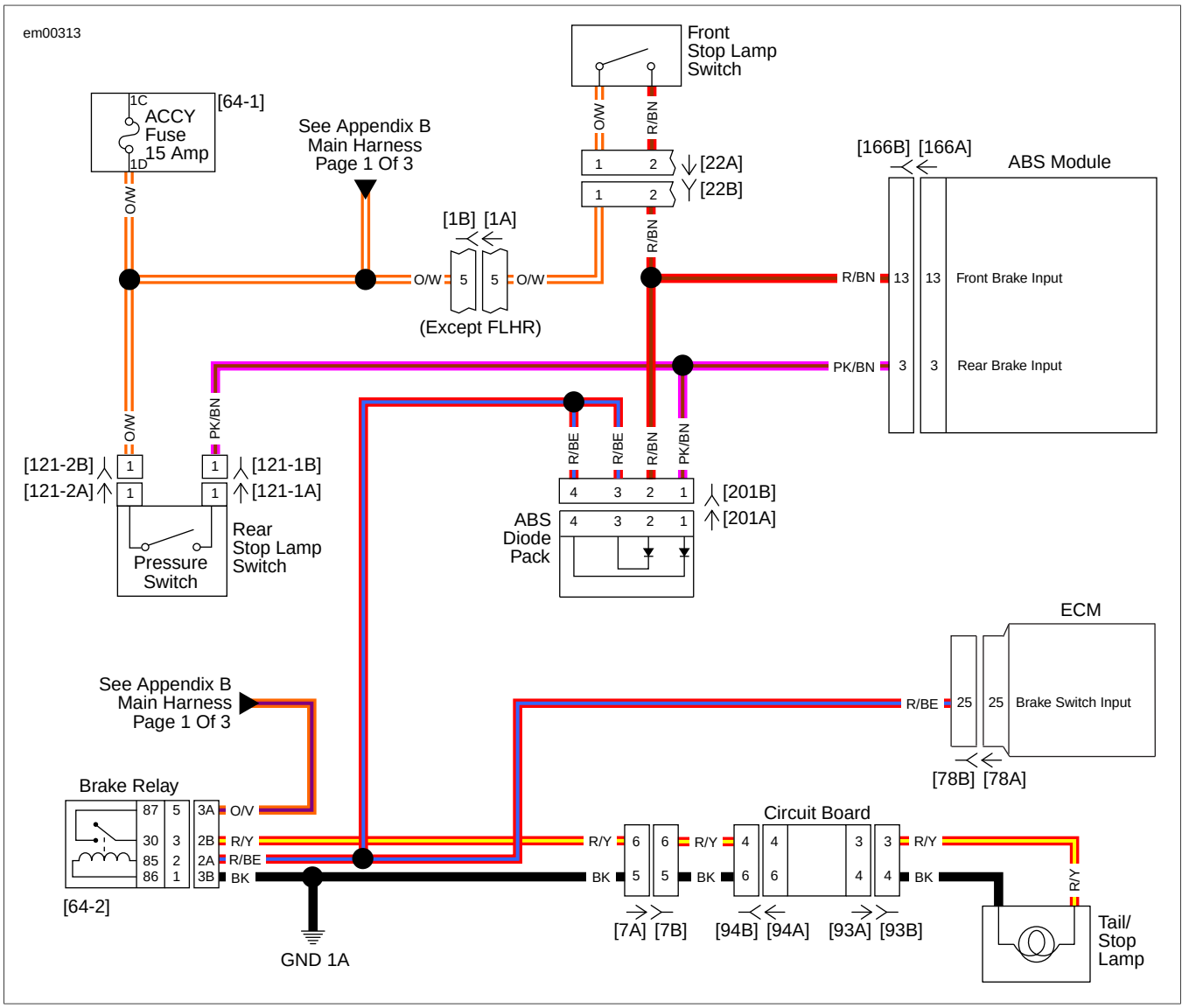


Figure 6-24. Brake Switches Schematic

Table 6-12. FLHX, FLHT/C/U Connector Locations

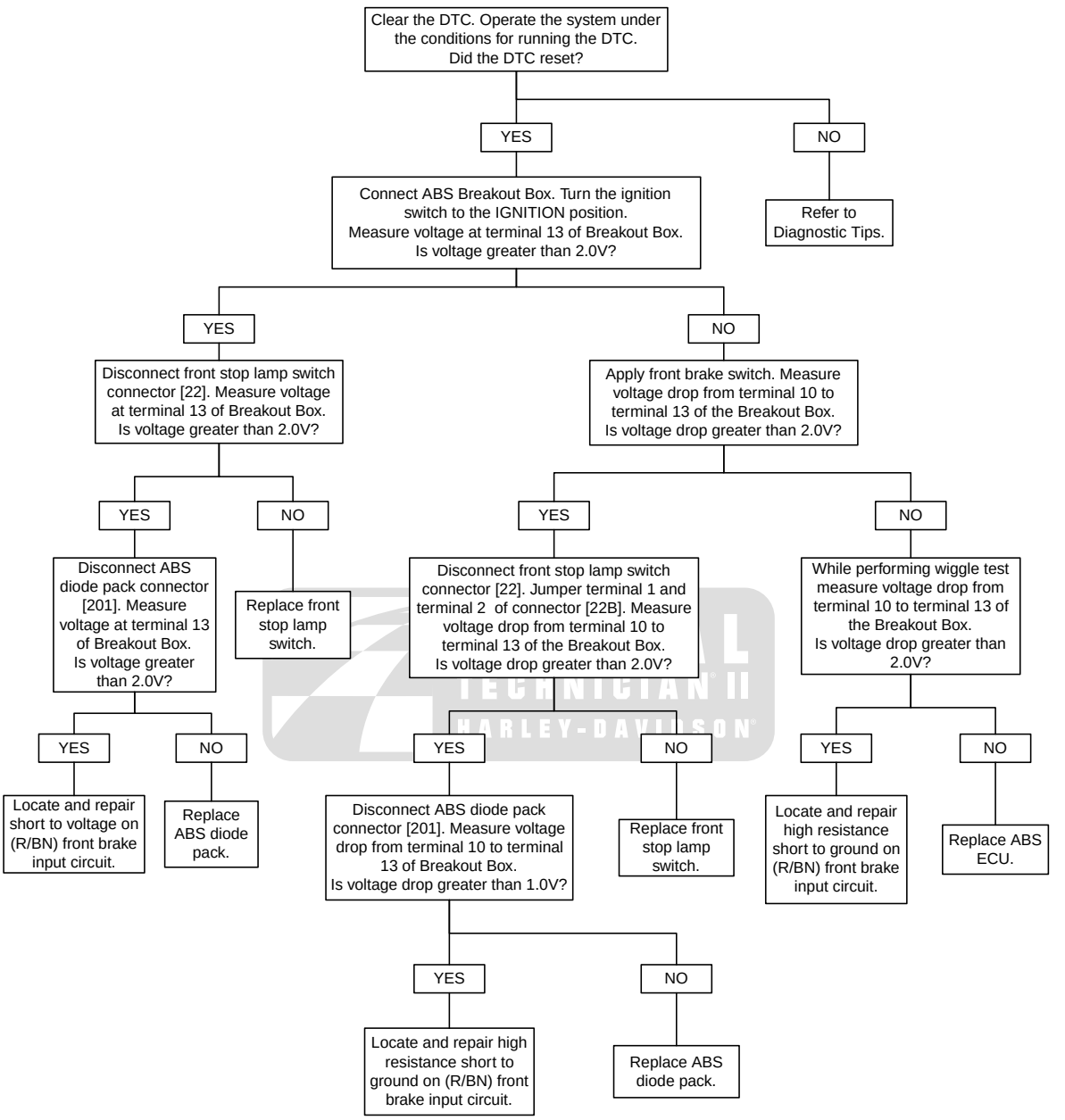
NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	FLHT/C/U/X - inner fairing - right radio support bracket FLTR - inner fairing right side below radio
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[22]	Interconnect to right handlebar switches	12-place Molex (black)	FLHT/C/U/X - inner fairing - right fairing support brace FLTR - inner fairing left side radio bracket
[64-1]	Fuse block	Packard	Under left side cover
[64-2]	Fuse block	Packard	Under left side cover
[78]	ECM	73-place Delphi	Under seat
[93]	Tail/Stop lamp	4-place Multilock	Circuit board under tail lamp assembly

Table 6-12. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[94]	Rear fender light harness to circuit board	6-place Multilock	Circuit board under tail lamp assembly
[121]	Rear brake switch	Spade terminals	Lower right side behind exhaust
[166]	ABS module	20-place	Behind right side cover
[201]	ABS diode pack	4-place	Behind left side cover

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DTC C1095



Clear DTCs using speedometer self-diagnostics. See 6.2 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

fc02255_en

DTC C1151 6.17

DTC C1151: FRONT WHEEL RELEASE TOO LONG

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The ABS module activates the valve relay to supply voltage to the valve solenoids. This voltage is referred to as the system voltage. The ABS module microprocessor activates individual valve solenoids by grounding the valve solenoid control circuits.

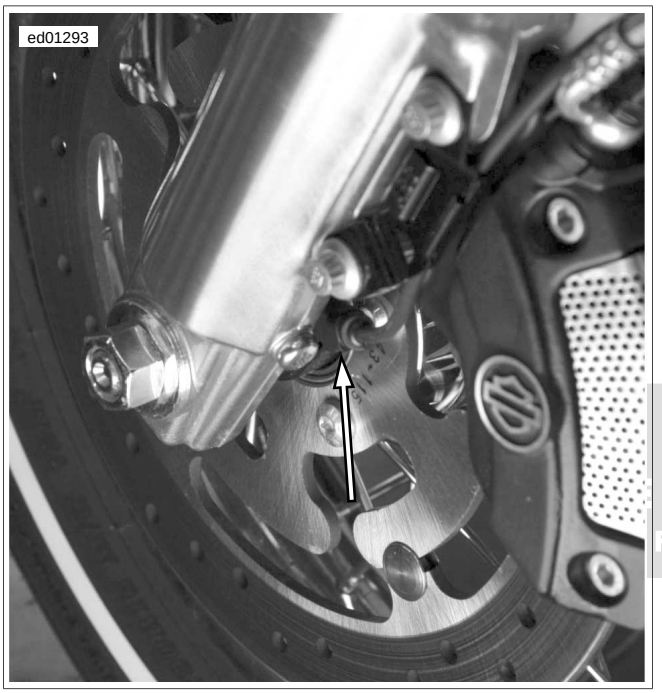


Figure 6-25. Front Wheel Speed Sensor

Conditions for Running the DTC

Ignition voltage is greater than 6.5 Volts.

Conditions for Setting the DTC

The DTC sets if all of the following conditions exist.

- ABS is commanding a pressure release from the front wheel release valve.
- front wheel speed is below 3 MPH (5 km/h) for more than one second.

Action Taken When the DTC Sets

- ABS is disabled.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ABS module automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- an intermittent wheel speed sensor.
- wheel speed sensor equals 0 MPH (0 km/h).
- internal ECU problem in the release solenoid.
- internal problem in the HCU.
- brake lines reversed on the HCU inlet and outlet ports.
- a stuck or seized caliper or bald tires could contribute to this code setting.

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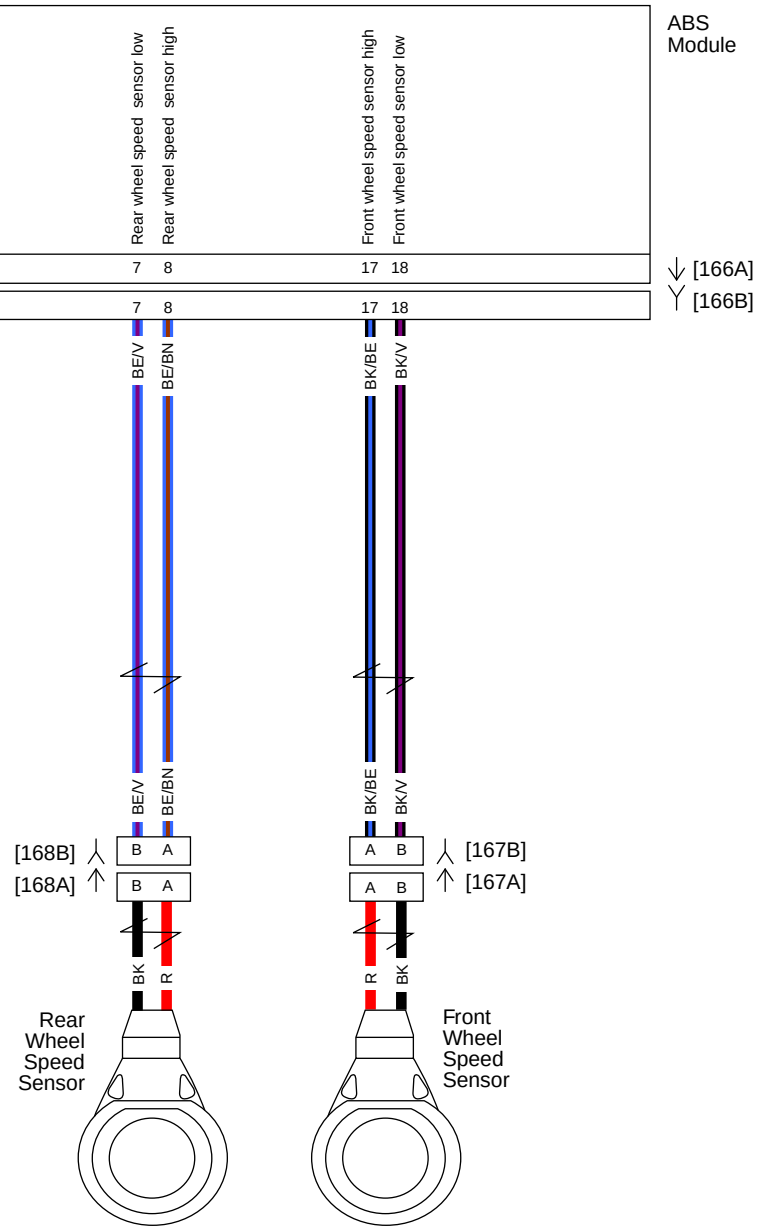
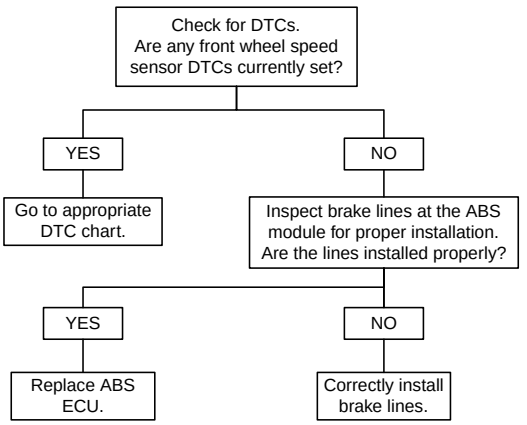


Figure 6-26. Wheel Speed Sensor Schematic

Table 6-13. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Packard	Above lower fork bracket (left side)
[168]	Rear wheel speed sensor	2-place Packard	Under right side cover, rear of ABS mount

DTC C1151



Clear DTCs using speedometer self-diagnostics. See 6.2 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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DTC C1153 6.18

DTC C1153: REAR WHEEL RELEASE TOO LONG

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The ABS module activates the valve relay to supply voltage to the valve solenoids. This voltage is referred to as the system voltage. The ABS module microprocessor activates individual valve solenoids by grounding the valve solenoid control circuits.

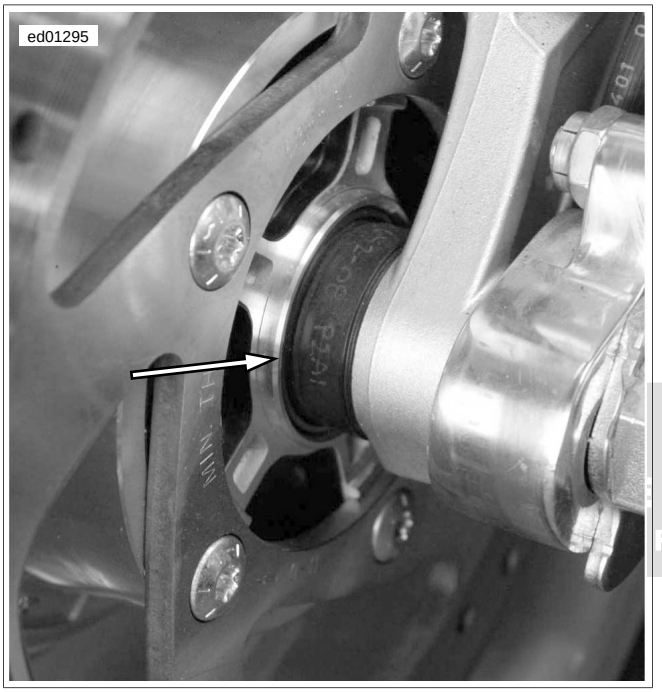


Figure 6-27. Rear Wheel Speed Sensor

Conditions for Running the DTC

Ignition voltage is greater than 6.5 Volts.

Conditions for Setting the DTC

The DTC sets if all of the following conditions exist:

- ABS is commanding a pressure release from the rear wheel release valve.
- rear wheel speed is below 3 MPH (5 km/h) for more than one second.

Action Taken When the DTC Sets

- ABS is disabled.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ABS module automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- an intermittent wheel speed sensor.
- wheel speed sensor equals 0 MPH (0 km/h).
- internal ECU problem in the release solenoid.
- internal problem in the HCU.
- brake lines reversed on the HCU inlet and outlet ports.
- stuck or seized caliper or bald tires.

em00158

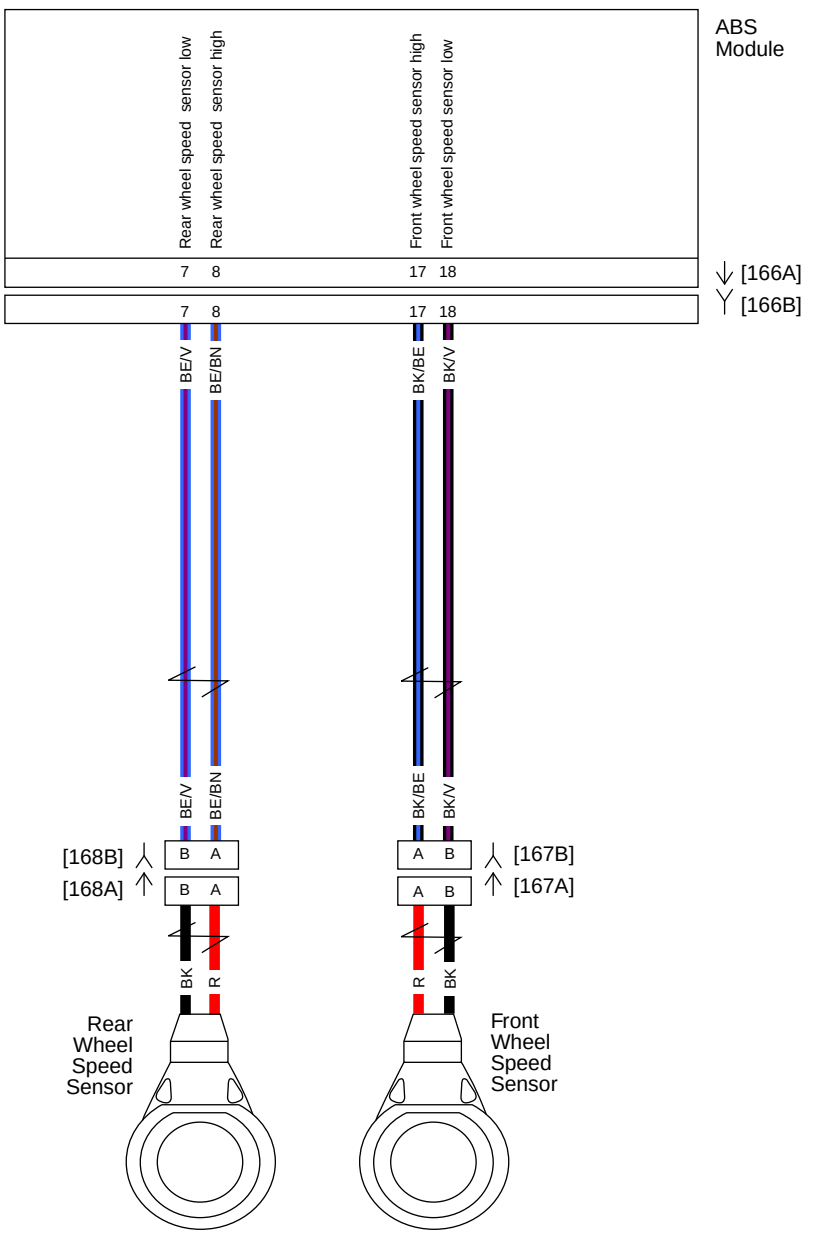
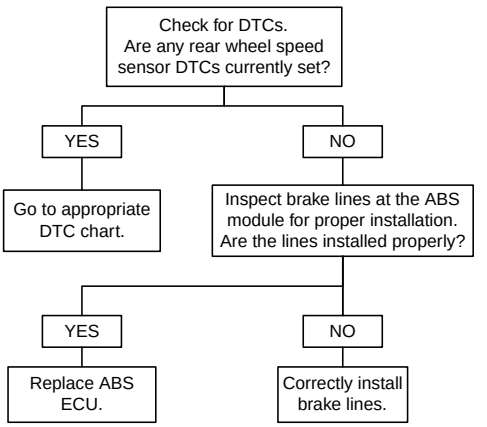


Figure 6-28. Wheel Speed Sensor Schematic

Table 6-14. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Packard	Above lower fork bracket (left side)
[168]	Rear wheel speed sensor	2-place Packard	Under right side cover, rear of ABS mount

DTC C1153



Clear DTCs using speedometer self-diagnostics. See 6.2 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

fc02257_en

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC C1158 6.19

DTC C1158: CALIBRATION PROGRAMMING REQUIRED

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The ECU is calibrated to maximize ABS performance. If the correct calibration is not in the module the ABS may not perform correctly.

Conditions for Running the DTC

Ignition voltage is greater than 6.5 Volts.

Conditions for Setting the DTC

The ABS module determines final calibration is not completed.

Action Taken When the DTC Sets

- ABS is disabled.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with DIGITAL TECHNICIAN II (Part No. HD-48650). This code may be set whenever an ABS module is replaced. The code on the new module has to be cleared using DIGITAL TECHNICIAN II (Part No. HD-48650).

The ABS module automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- ECU that is not calibrated correctly or has an internal fault.
- all replacement ABS modules have this DTC set.

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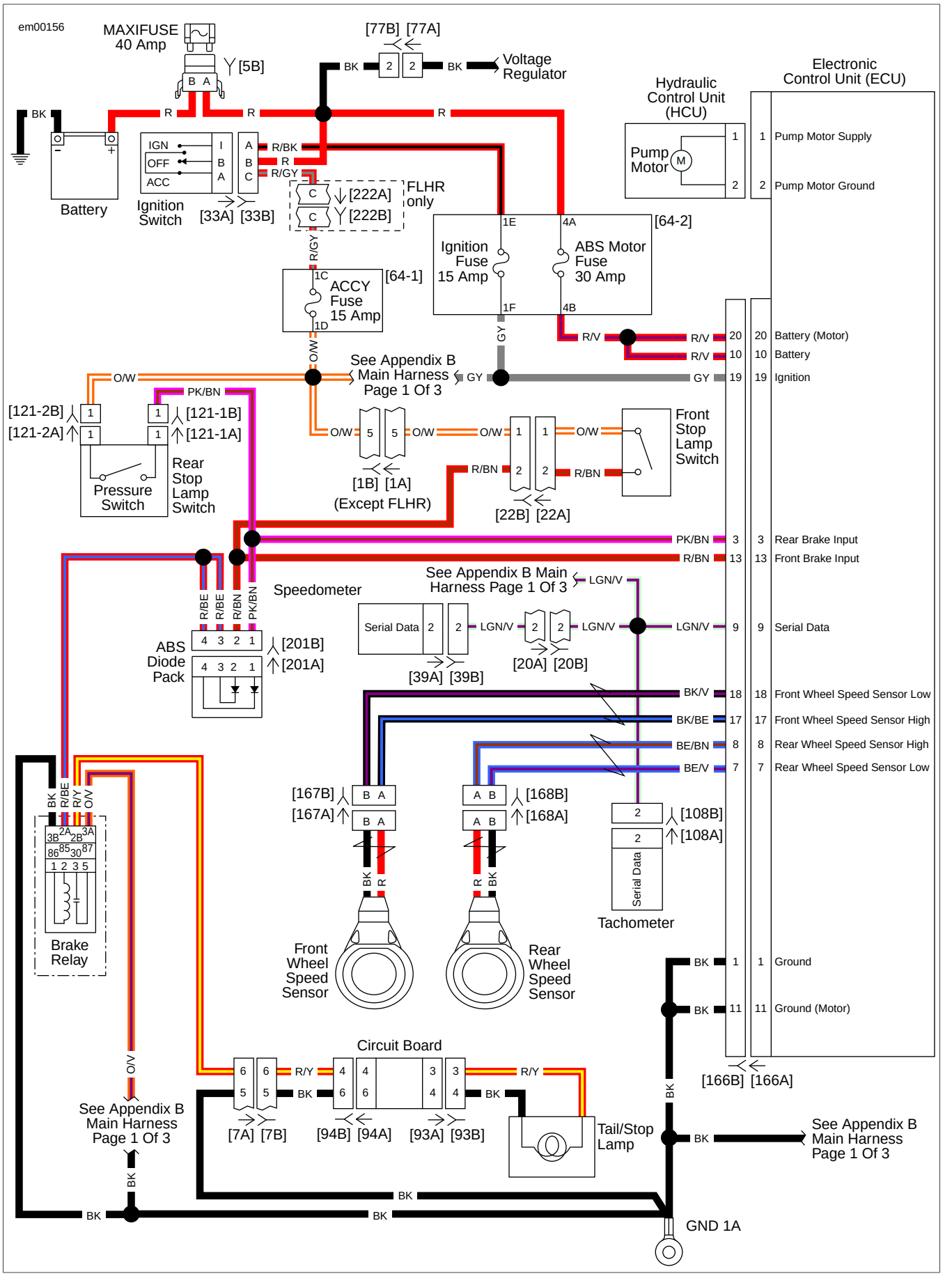


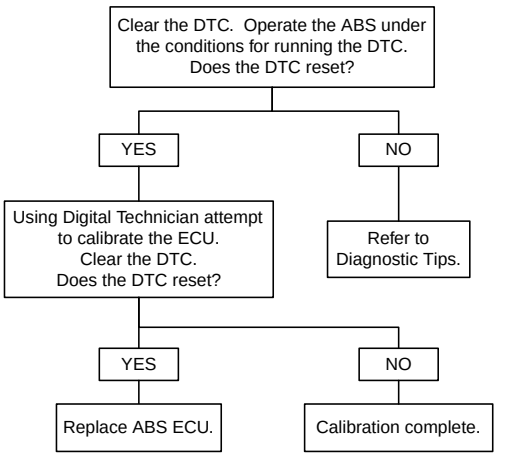
Figure 6-29. ABS Schematic

Table 6-15. Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	FLHT/C/U/X - inner fairing - right radio support bracket FLTR - inner fairing right side below radio
[5]	MAXIFUSE	2-place Packard	Under left side cover
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[20]	Console harness	16-place Molex	FLHR - under seat
[22]	Interconnect to right handlebar switches	12-place Molex (black)	FLHT/C/U/X - inner fairing - right fairing support brace FLTR - inner fairing left radio bracket FLHR - inside headlamp nacelle
[33]	Ignition switch	3-place Packard	FLHT/C/U/X, FLTR - front of ignition switch housing FLHR - Under console
[39]	Speedometer	12-place Packard	FLHT/C/U - inner fairing (back of speedometer) FLTR - under bezel (back of speedometer) FLHR - under console (back of speedometer)
[64-1]	Fuse block	Packard	Under left side cover
[64-2]	Fuse block	Packard	Under left side cover
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)
[93]	Tail/stop lamp	4-place Multilock	Circuit board under tail lamp assembly
[94]	Rear fender light harness to circuit board	6-place Multilock	Circuit board under tail lamp assembly
[108]	Tachometer	12-place Packard	FLHT/C/U/X - inner fairing (back of tachometer) FLTR - under bezel (back of tachometer)
[121]	Rear brake light switch	Spade terminals	Bottom of rear frame downtube (right side)
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Packard	Above left side lower fork bracket
[168]	Rear wheel speed sensor	2-place Packard	Under right side cover, rear of ABS module mount
[201]	ABS diode pack	4-place Deutsch	Under left side cover
[222]	Main to ignition harness	4-place Packard	FLHR - rear of fuel tank

DIGITAL TECHNICIAN HARLEY-DAVIDSON

DTC C1158



Clear DTCs using speedometer self-diagnostics. See 6.2 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

fc02258_en

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC C1212 6.20

DTC C1212: FRONT OR REAR BRAKE NOT APPLIED WITH DECEL

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The ABS module monitors the front and rear brake switch inputs through terminals 13 and 3. This allows the ABS to determine if the brake is being applied or not when a wheel is decelerating.

Conditions for Running the DTC

Ignition voltage is greater than 6.5 Volts.

Conditions for Setting the DTC

The DTC sets if the following conditions exist. The first four conditions have to occur twice.

- front or rear brake is not applied.
- no current ABS event in progress.
- vehicle speed exceeds 15 MPH (24 km/h).
- vehicle decelerates at a rate greater than 5 MPH (8 km/h) per second for more than two seconds.
- vehicle speed drops below 15 MPH (24 km/h).

Action Taken When the DTC Sets

No action is taken when this code is set. The ABS indicator does not illuminate and the ABS is still active.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ECU automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- a short or open on the brake switch input circuits to the ABS module.
- downshifting up a steep hill without using the brakes consecutive times could cause this code.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) with gray male probes and patch cords.

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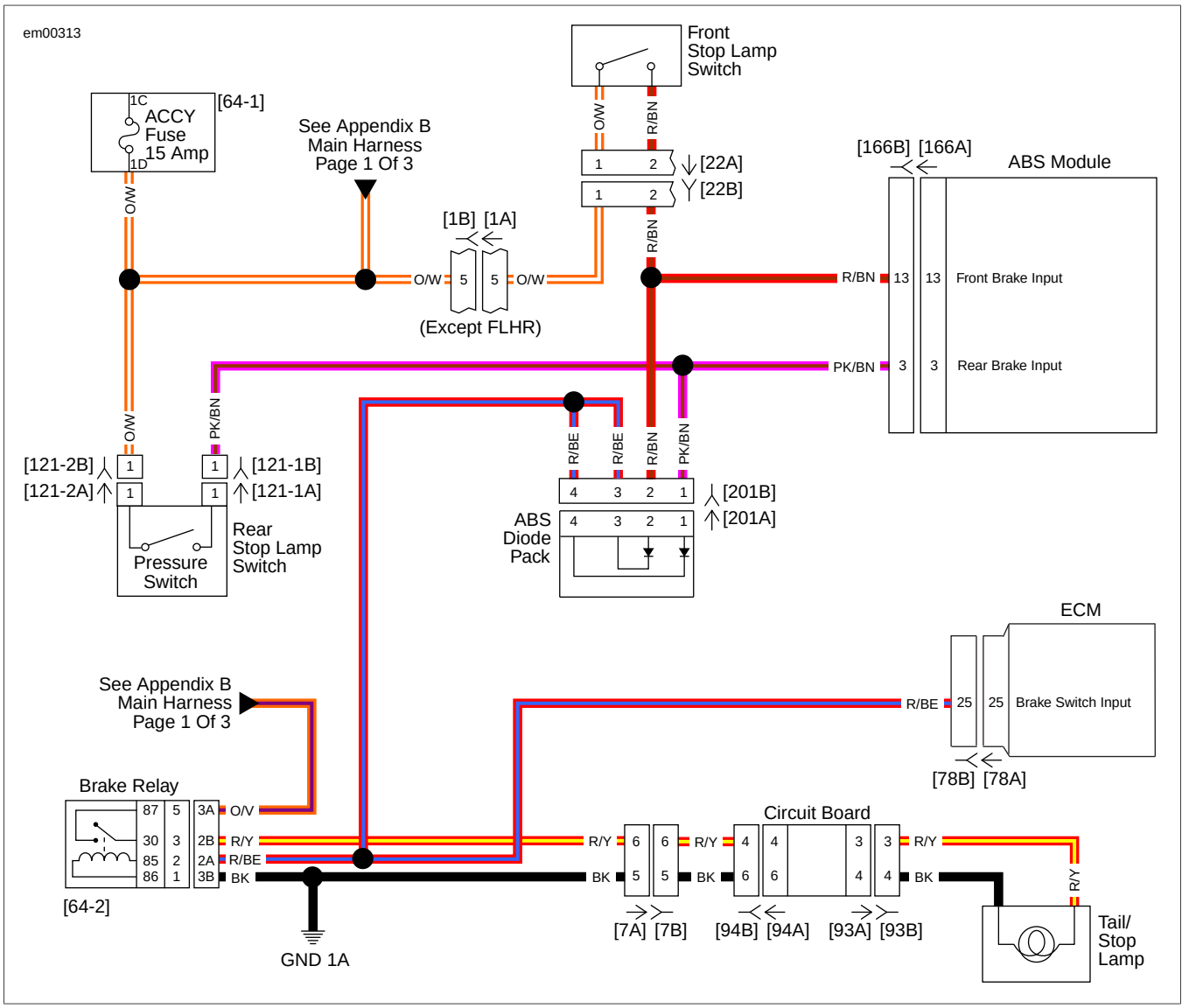


Figure 6-30. Brake Switches Schematic

Table 6-16. FLHX, FLHT/C/U Connector Locations

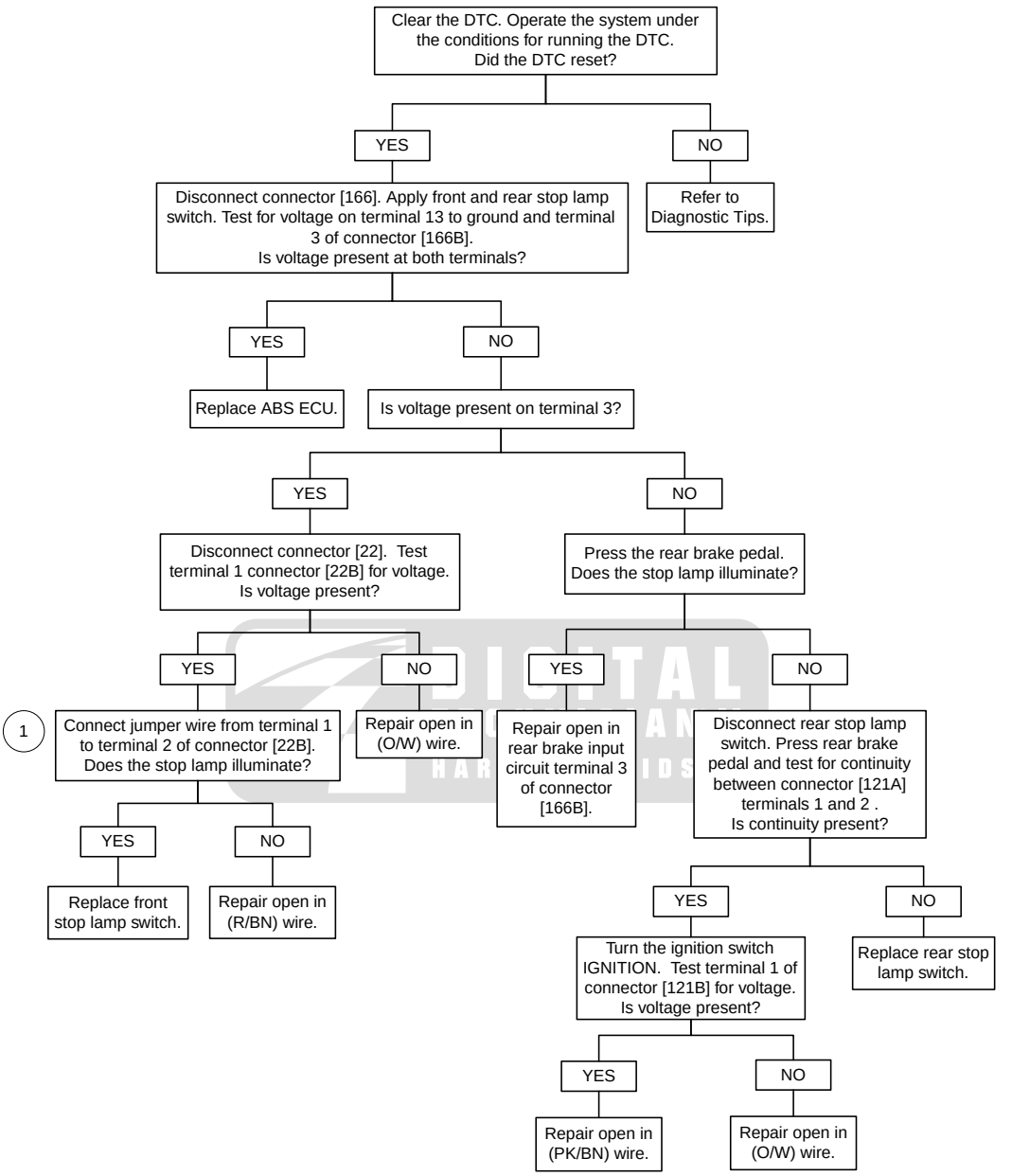
NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	FLHT/C/U/X - inner fairing - right radio support bracket FLTR - inner fairing right side below radio
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[22]	Interconnect to right handlebar switches	12-place Molex (black)	FLHT/C/U/X - inner fairing - right fairing support brace FLTR - inner fairing left side radio bracket
[64-1]	Fuse block	Packard	Under left side cover
[64-2]	Fuse block	Packard	Under left side cover
[78]	ECM	73-place Delphi	Under seat
[93]	Tail/Stop lamp	4-place Multilock	Circuit board under tail lamp assembly

Table 6-16. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[94]	Rear fender light harness to circuit board	6-place Multilock	Circuit board under tail lamp assembly
[121]	Rear brake switch	Spade terminals	Lower right side behind exhaust
[166]	ABS module	20-place	Behind right side cover
[201]	ABS diode pack	4-place	Behind left side cover

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DTC C1212



Clear DTCs using speedometer self diagnostics.
See 6.2 SPEEDOMETER SELF DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

fc02259_en

DTC C1214 6.21

DTC C1214: REAR BRAKE SWITCH ALWAYS ON

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The ABS module monitors the rear brake switch input. When the brake pedal is applied the ABS module receives voltage on the rear brake switch circuit. The ABS module uses this signal to enhance ABS operation.

Conditions for Running the DTC

Ignition voltage is greater than 6.5 Volts.

Conditions for Setting the DTC

The DTC sets if all of the following conditions exist for 2 seconds:

- ABS module sees a rear brake input.
- vehicle speed exceeds 25 MPH (40 km/h).
- vehicle acceleration exceeds 5 MPH/second (8 km/h/second).

Action Taken When the DTC Sets

No action is taken when this code is set. The ABS indicator does not illuminate and the ABS is still active.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ABS module automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- short to voltage between the rear brake switch and the ABS module.
- rear brake switch stuck closed or applied during acceleration.
- internal rear brake sensing malfunction.

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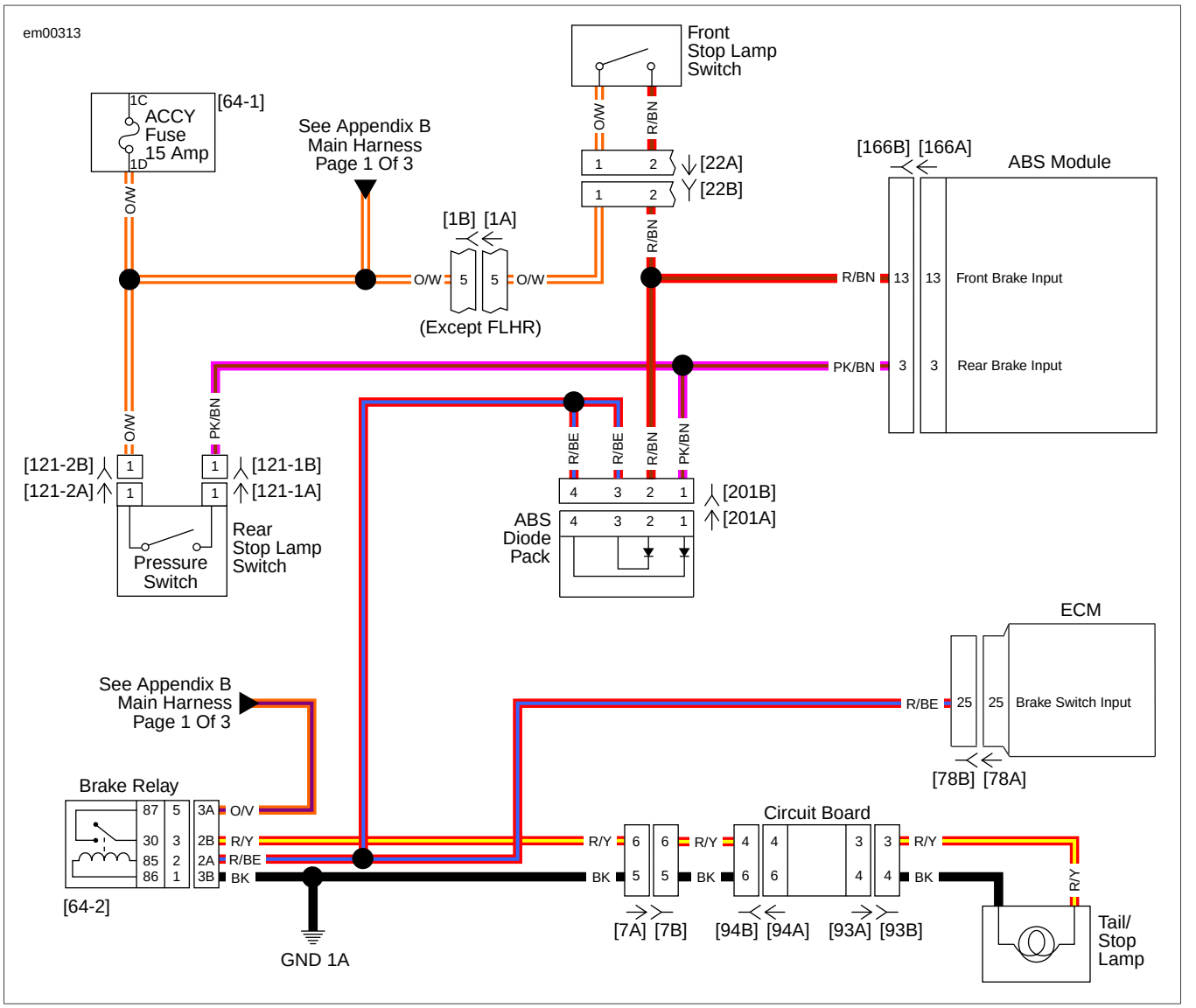


Figure 6-31. Brake Switches Schematic

Table 6-17. FLHX, FLHT/C/U Connector Locations

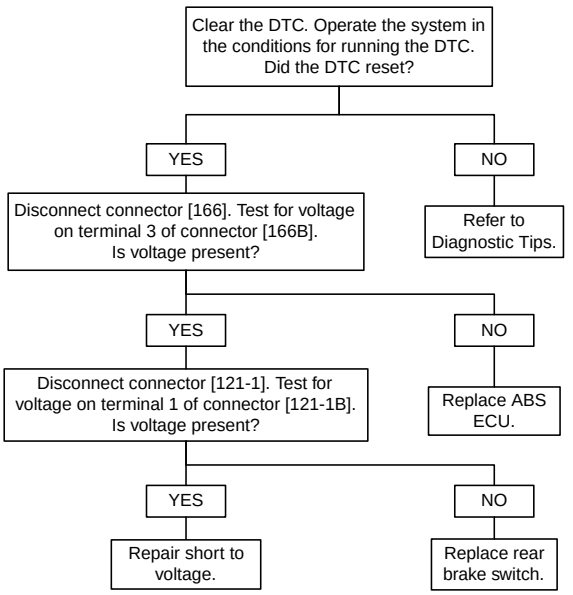
NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	FLHT/C/U/X - inner fairing - right radio support bracket FLTR - inner fairing right side below radio
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[22]	Interconnect to right handlebar switches	12-place Molex (black)	FLHT/C/U/X - inner fairing - right fairing support brace FLTR - inner fairing left side radio bracket
[64-1]	Fuse block	Packard	Under left side cover
[64-2]	Fuse block	Packard	Under left side cover
[78]	ECM	73-place Delphi	Under seat
[93]	Tail/Stop lamp	4-place Multilock	Circuit board under tail lamp assembly

Table 6-17. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[94]	Rear fender light harness to circuit board	6-place Multilock	Circuit board under tail lamp assembly
[121]	Rear brake switch	Spade terminals	Lower right side behind exhaust
[166]	ABS module	20-place	Behind right side cover
[201]	ABS diode pack	4-place	Behind left side cover

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DTC C1214



Clear DTCs using speedometer self-diagnostics. See 6.2 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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DTC C1216 6.22

DTC C1216: REAR BRAKE SWITCH OPEN

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The ABS module monitors the rear brake switch input. When the brake pedal is applied the ABS module receives voltage on the rear brake switch circuit. The ABS module uses this signal to enhance ABS operation.

Conditions for Running the DTC

- ignition voltage is greater than 6.5 Volts.
- front brake switch is not closed (brake applied).

Conditions for Setting the DTC

The DTC sets if all of the following conditions exist for 2 seconds:

- ABS module detects an open in the rear brake input circuit.
- ABS module detects an open in the ground circuit to the rear brake switch.

Action Taken When the DTC Sets

No action is taken when this code is set. The ABS indicator does not illuminate and the ABS is still active.

Conditions for Clearing the DTC

The condition for the DTC is no longer present and the DTC has been cleared with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

The ECU automatically clears the historic DTC when a current DTC is not detected in 50 consecutive drive cycles.

Diagnostic Tips

The following conditions are possible causes for this fault:

- open or loose connection in the rear brake input circuit.
- all brake lamps are open or burned out.
- ground path to the brake lamps is open.
- internal ABS module problem in the rear brake input circuitry.

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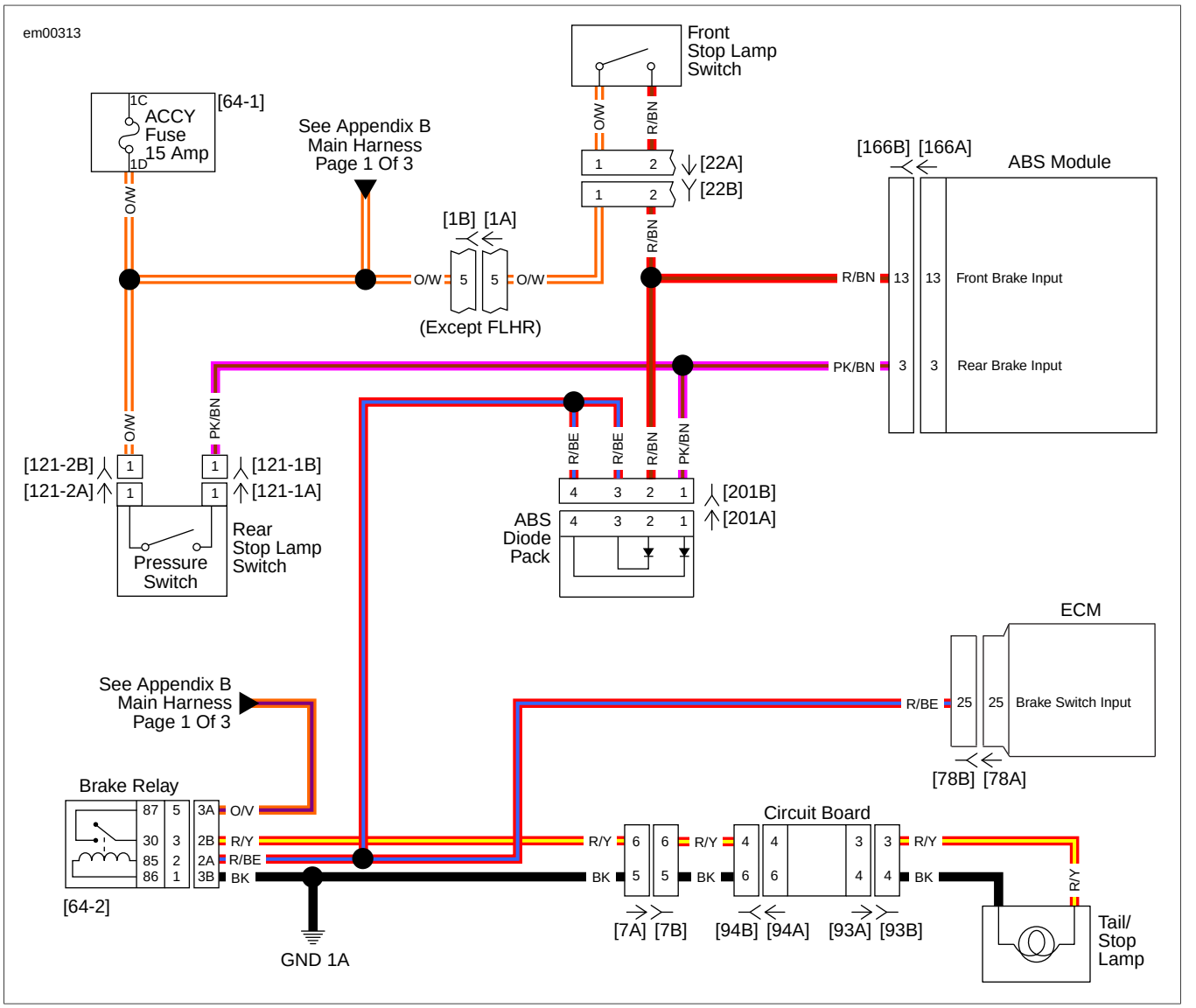


Figure 6-32. Brake Switches Schematic

Table 6-18. FLHX, FLHT/C/U Connector Locations

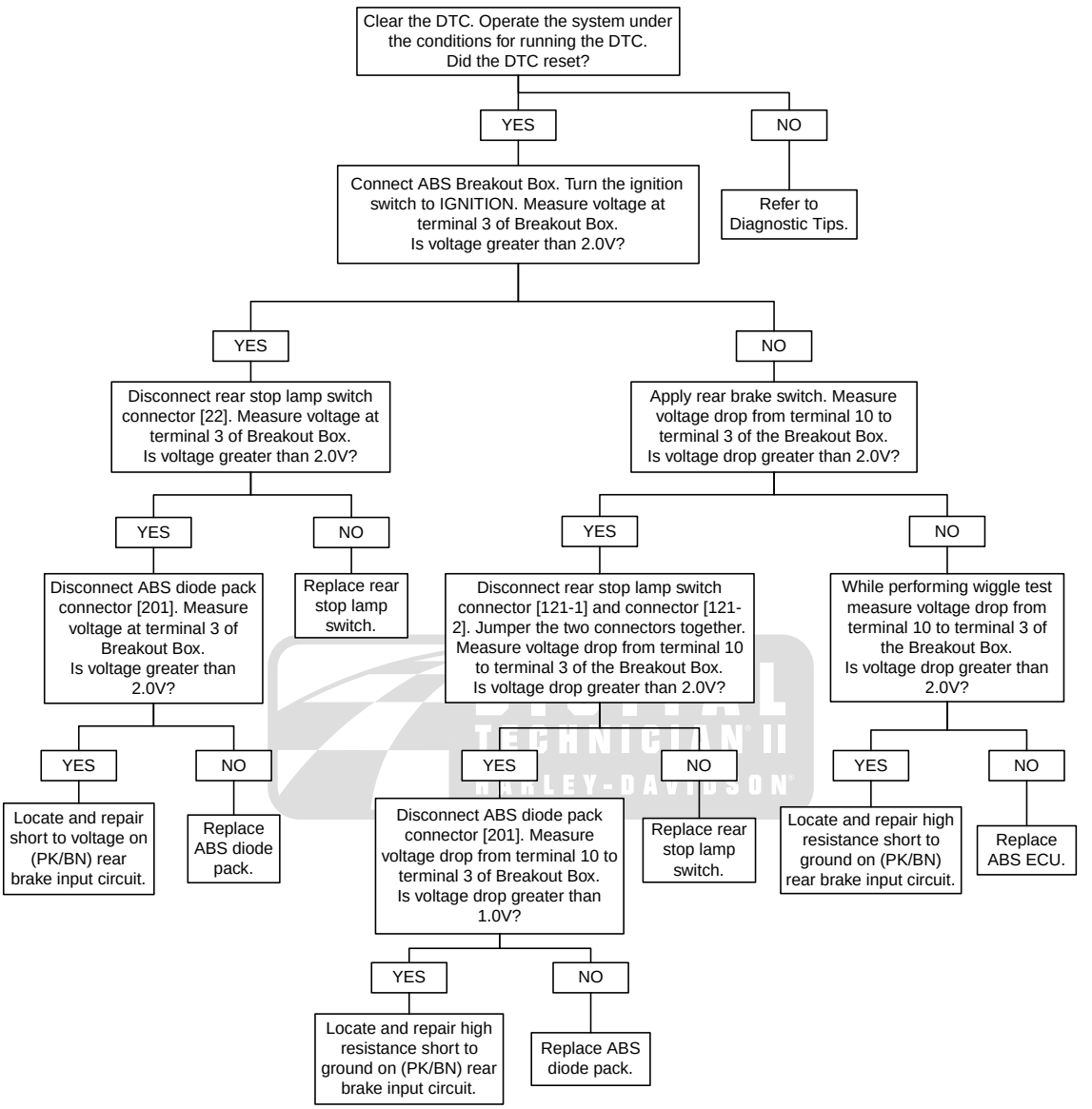
NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	FLHT/C/U/X - inner fairing - right radio support bracket FLTR - inner fairing right side below radio
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[22]	Interconnect to right handlebar switches	12-place Molex (black)	FLHT/C/U/X - inner fairing - right fairing support brace FLTR - inner fairing left side radio bracket
[64-1]	Fuse block	Packard	Under left side cover
[64-2]	Fuse block	Packard	Under left side cover
[78]	ECM	73-place Delphi	Under seat
[93]	Tail/Stop lamp	4-place Multilock	Circuit board under tail lamp assembly

Table 6-18. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[94]	Rear fender light harness to circuit board	6-place Multilock	Circuit board under tail lamp assembly
[121]	Rear brake switch	Spade terminals	Lower right side behind exhaust
[166]	ABS module	20-place	Behind right side cover
[201]	ABS diode pack	4-place	Behind left side cover

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DTC C1216



Clear DTCs using speedometer self-diagnostics. See 6.2 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

fc02261_en

DTC C1014, C1055-C1066, C1118, C1121 6.23

DTC C1014, C1055-C1066, C1118, C1121: ECU INTERNAL FAULT

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Circuit Description

The ABS module monitors the voltage level available for system operation. A low voltage condition prevents the system from operating properly. The ABS module also performs several self-tests for internal problems which may affect proper operation.

Conditions for Running the DTC

Ignition voltage is greater than 6.5 Volts.

Conditions for Setting the DTC

The ABS module detects an internal malfunction.

Action Taken When the DTC Sets

- ABS is disabled.
- ABS indicator is illuminated.

Conditions for Clearing the DTC

Certain conditions that may cause this DTC to set cannot be cleared. Other conditions that may cause this DTC to set may be cleared, at least temporarily, with either a "WOW" test or DIGITAL TECHNICIAN II (Part No. HD-48650).

Diagnostic Tips

The following conditions are possible causes for this fault:

- internal system malfunction.
- faulty system voltage supply to the module.
- faulty system ground.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. The ignition circuit consists of all the circuitry back to and including the ignition switch.

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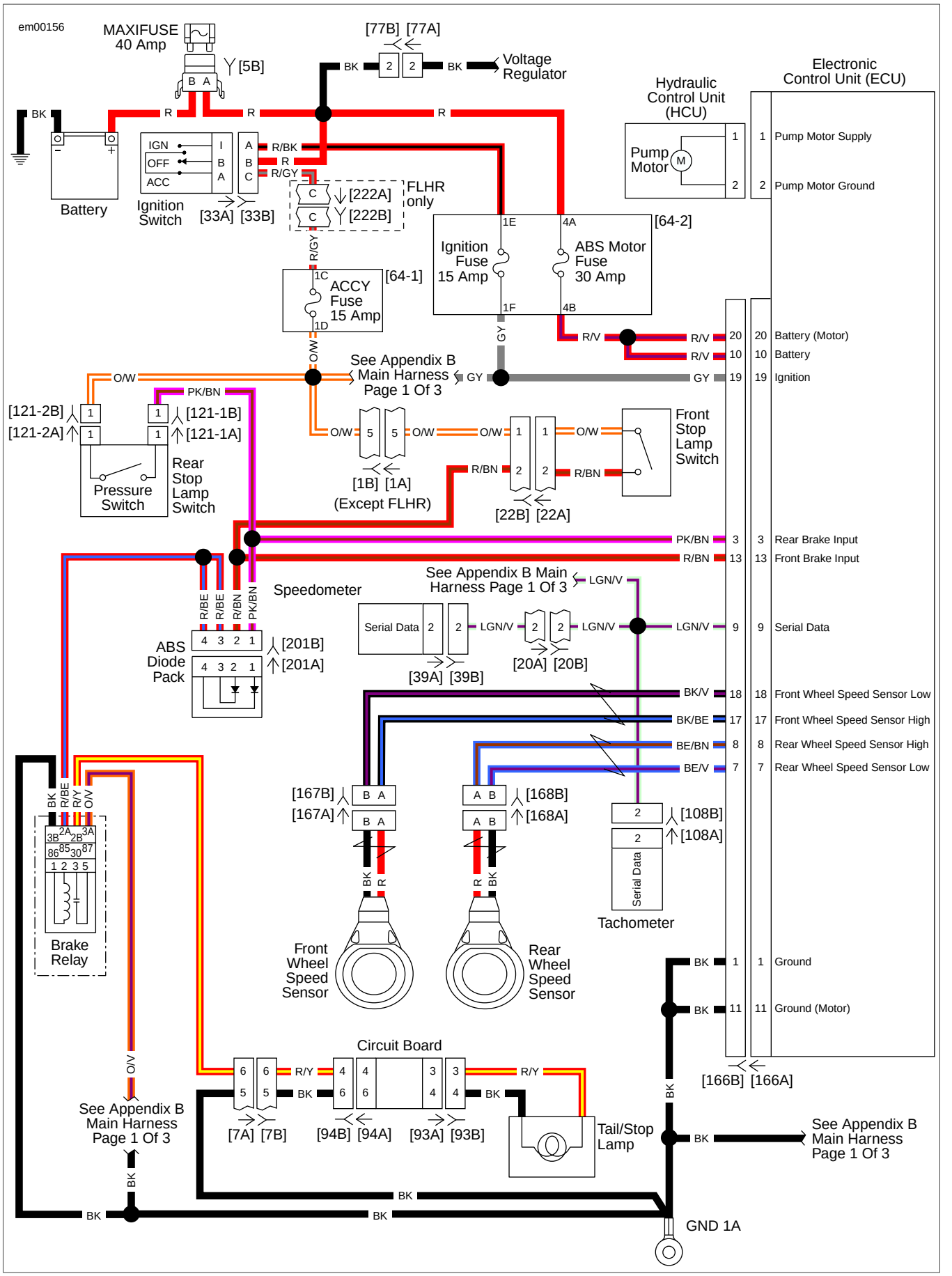


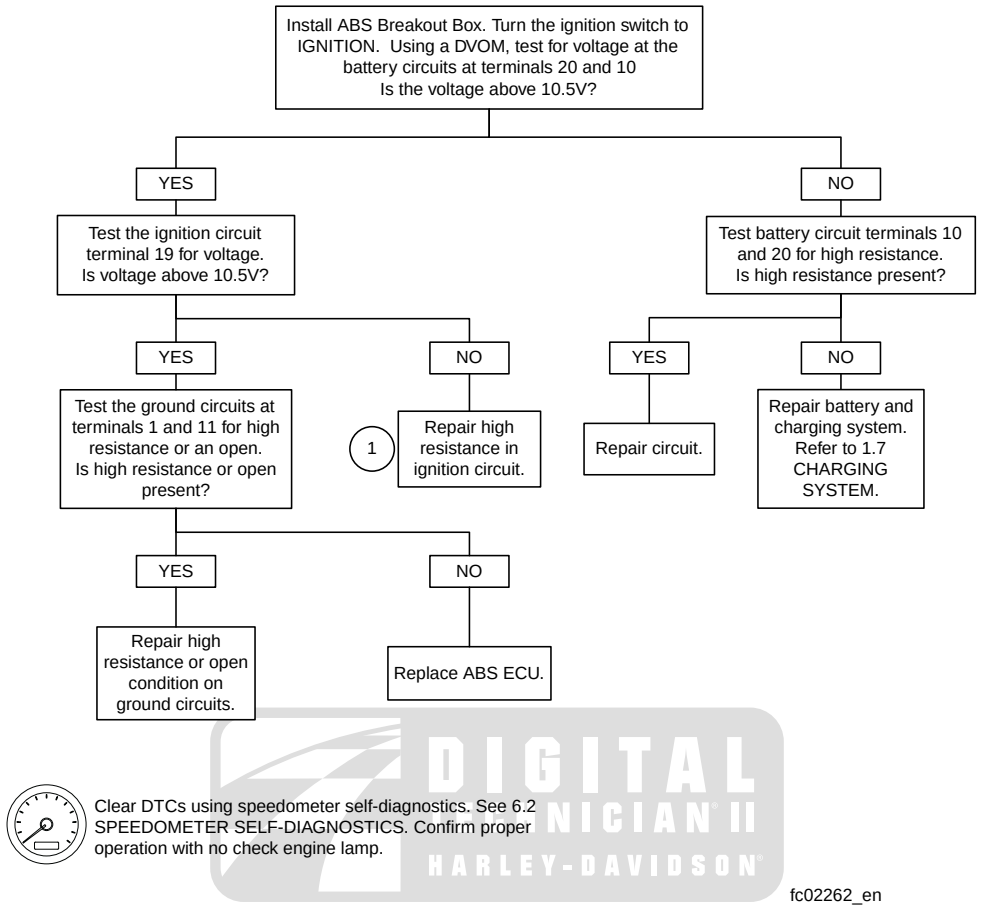
Figure 6-33. ABS Schematic

Table 6-19. Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	FLHT/C/U/X - inner fairing - right radio support bracket FLTR - inner fairing right side below radio
[5]	MAXIFUSE	2-place Packard	Under left side cover
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[20]	Console harness	16-place Molex	FLHR - under seat
[22]	Interconnect to right handlebar switches	12-place Molex (black)	FLHT/C/U/X - inner fairing - right fairing support brace FLTR - inner fairing left radio bracket FLHR - inside headlamp nacelle
[33]	Ignition switch	3-place Packard	FLHT/C/U/X, FLTR - front of ignition switch housing FLHR - Under console
[39]	Speedometer	12-place Packard	FLHT/C/U - inner fairing (back of speedometer) FLTR - under bezel (back of speedometer) FLHR - under console (back of speedometer)
[64-1]	Fuse block	Packard	Under left side cover
[64-2]	Fuse block	Packard	Under left side cover
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)
[93]	Tail/stop lamp	4-place Multilock	Circuit board under tail lamp assembly
[94]	Rear fender light harness to circuit board	6-place Multilock	Circuit board under tail lamp assembly
[108]	Tachometer	12-place Packard	FLHT/C/U/X - inner fairing (back of tachometer) FLTR - under bezel (back of tachometer)
[121]	Rear brake light switch	Spade terminals	Bottom of rear frame downtube (right side)
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Packard	Above left side lower fork bracket
[168]	Rear wheel speed sensor	2-place Packard	Under right side cover, rear of ABS module mount
[201]	ABS diode pack	4-place Deutsch	Under left side cover
[222]	Main to ignition harness	4-place Packard	FLHR - rear of fuel tank

DIGITAL TECHNICIAN HARLEY-DAVIDSON

DTCs C1014, C1055 through C1066, C1118, and C1121

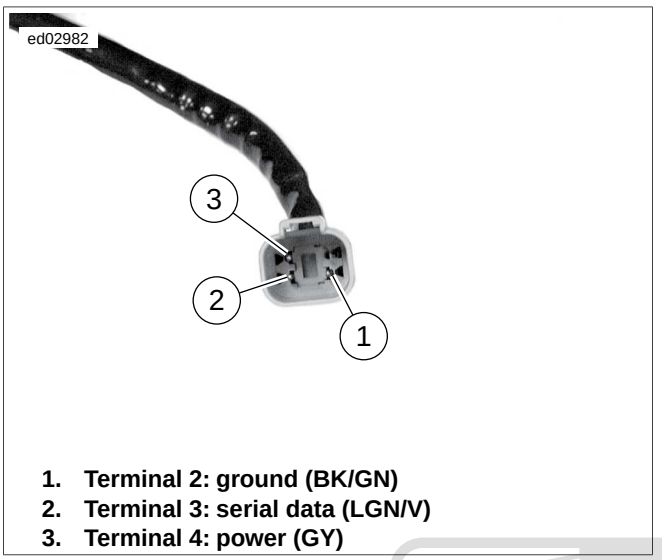


DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC U1300, U1301 OR BUS ER 6.24

DIAGNOSTICS

The typical serial data voltage range is zero (inactive) to 7 Volts (active). Due to the short pulse, voltage is much lower on a DVOM. In analog mode, a DVOM reading serial data shows continuous voltage when active, typically 0.6-0.8 Volts. The range for acceptable operations is 0-7.0 Volts.



1. **Terminal 2: ground (BK/GN)**
2. **Terminal 3: serial data (LGN/V)**
3. **Terminal 4: power (GY)**

Figure 6-34. Data Link Connector

Diagnostic Tips

- If serial data is shorted, these DTCs automatically cause the check engine lamp to illuminate. The odometer reads BUS Er in this condition.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.

Diagnostic Notes

If a U1300, U1301 or BUS Er is present, perform diagnostic procedures listed in 4.11 STARTS, THEN STALLS.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

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DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

NOTES

AMP MULTILOCK CONNECTORS A.1

AMP MULTILOCK CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41609	AMP MULTILOCK CRIMPER
TT600-3	SNAP-ON PICK

General

AMP Multilock connectors are found between wire harnesses and component wiring and may be either floating or anchored to the frame with attachment clips.

See Figure A-1. Attachment clips (1) on the pin housings are fitted to T-studs on the motorcycle frame. The T-studs identify OE connector locations. To maintain serviceability, always return connectors to OE locations after service.

Obtain the necessary tools to repair the connector and terminals.

NOTE

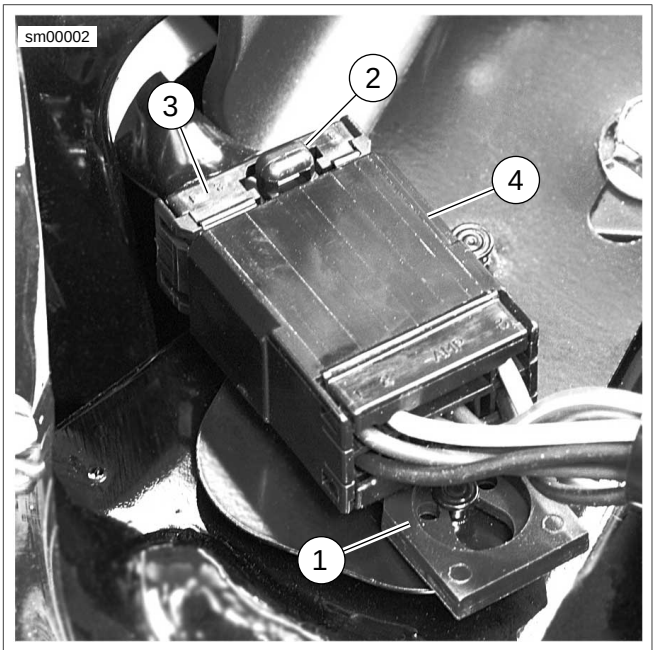
For terminal crimping use the AMP MULTILOCK CRIMPER (Part No. HD-41609).

Separating Pin and Socket Housings

1. If necessary, slide connector attachment clip T-stud to the large end of the opening.
2. See Figure A-1. Depress the release button (2) on the socket terminal side of the connector and pull the socket housing (3) out of the pin housing (4).

Mating Pin and Socket Housings

1. Hold the housings to match wire color to wire color.
2. Insert the socket housing into the pin housing until it snaps in place.
3. If OE location is a T-stud, fit large opening end of attachment clip over T-stud and slide connector to engage T-stud to small end of opening.



1. **Attachment clip**
2. **Release button**
3. **Socket housing**
4. **Pin housing**

Figure A-1. AMP Multilock Connector

Removing Terminals from Housing

1. See Figure A-2. Bend back the latch (1) to free one end of secondary lock (2) then repeat on the opposite end. Hinge the secondary lock outward.
2. Look in the terminal side of the connector (opposite the secondary lock) and note the cavity next to each terminal.
3. Insert a pick or pin into the terminal cavity until it stops.

NOTE

If socket/pin terminal tool is not available, a push pin/safety pin or a SNAP-ON PICK (Part No. TT600-3) may be used.

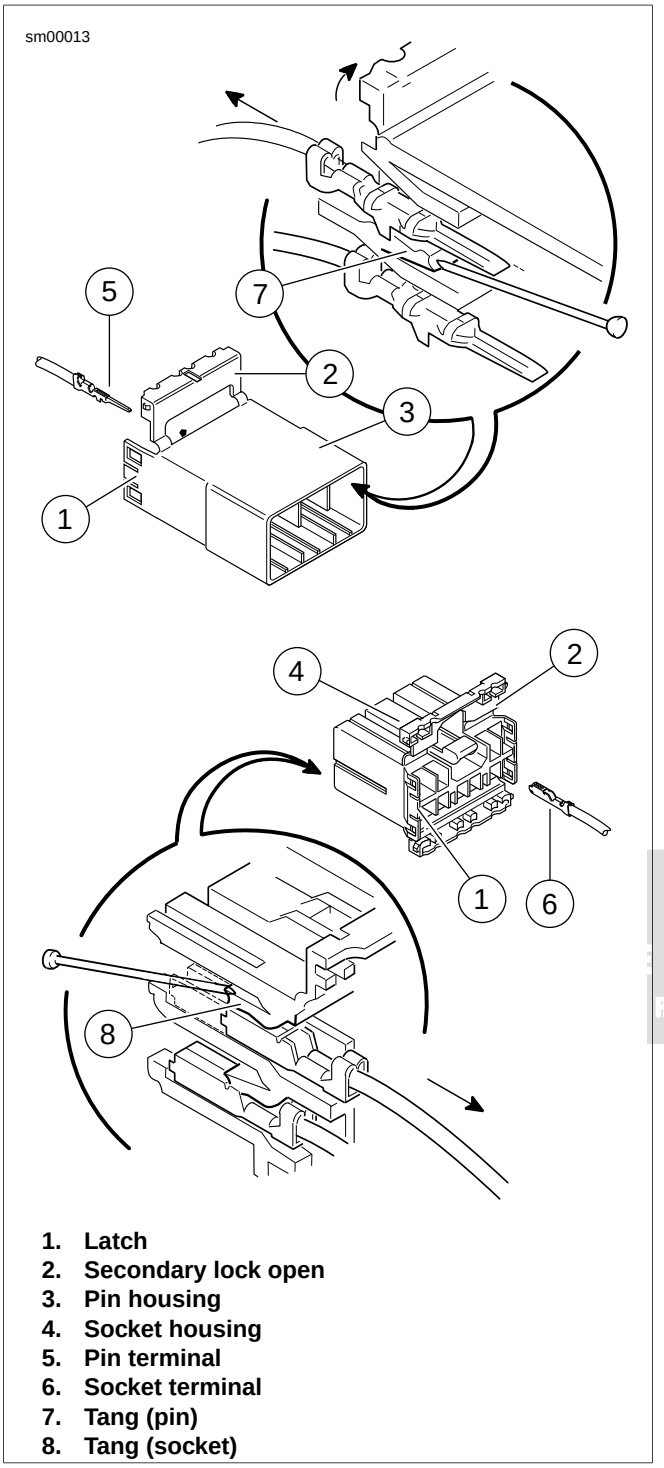
4. Press the tang in the housing to release the terminal.
 a. **Socket:** Lift the socket tang (8) up.
 b. **Pin:** Press the pin tang (7) down.

NOTE

A "click" is heard if the tang is released.

5. Gently tug on wire to pull wire and terminal from cavity.

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1. **Latch**
2. **Secondary lock open**
3. **Pin housing**
4. **Socket housing**
5. **Pin terminal**
6. **Socket terminal**
7. **Tang (pin)**
8. **Tang (socket)**

Figure A-2. AMP Multilock Connector: Socket and Pin Housings

Inserting Terminals into Housing

NOTE

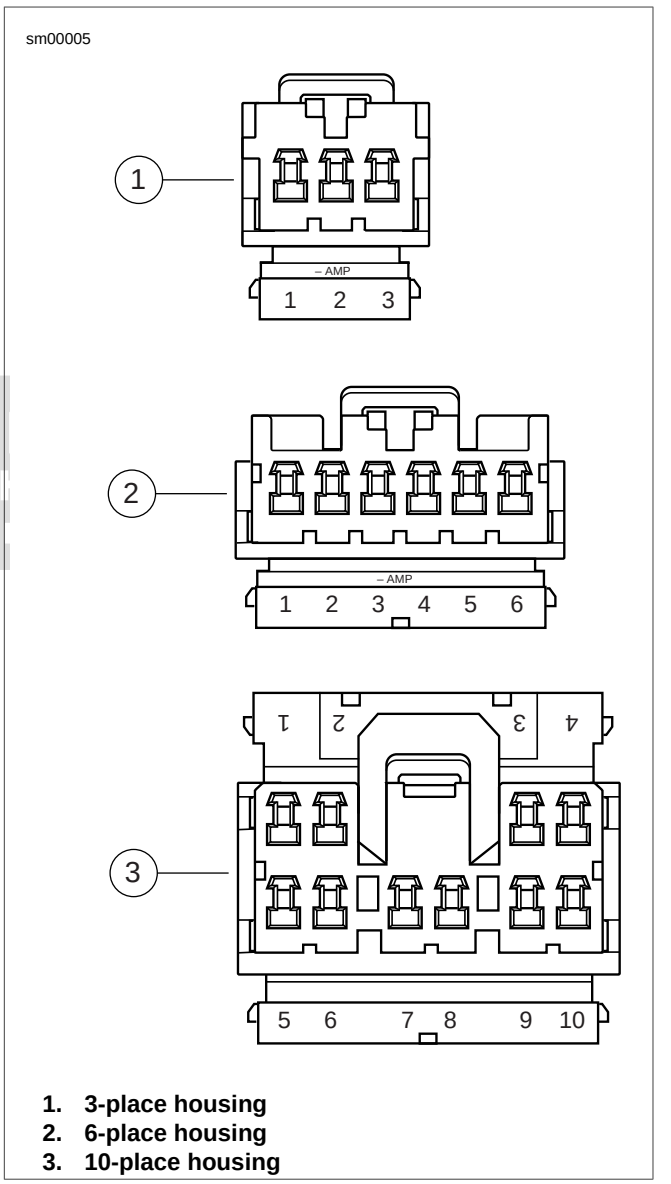
See Figure A-3. Cavity numbers are stamped into the secondary locks of both the socket and pin housings. Match the wire color to the cavity number found on the wiring diagram.

1. Hold the terminal so the catch faces the tang in the chamber. Insert the terminal into its numbered cavity until it snaps in place.

NOTES

- *Up and down can be determined by the position of the release button, the button is the top of the connector.*
- *On the pin side of the connector, tangs are positioned at the bottom of each cavity, so the slot in the pin terminal (on the side opposite the crimp tails) must face downward.*
- *On the socket side, tangs are at the top of each cavity, so the socket terminal slot (on the same side as the crimp tails) must face upward.*

2. Gently tug on wire end to verify that the terminal is locked in place.
3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.



1. **3-place housing**
2. **6-place housing**
3. **10-place housing**

Figure A-3. AMP Multilock Connector: Cavity Numbers on Secondary Locks (Socket Housings Shown)

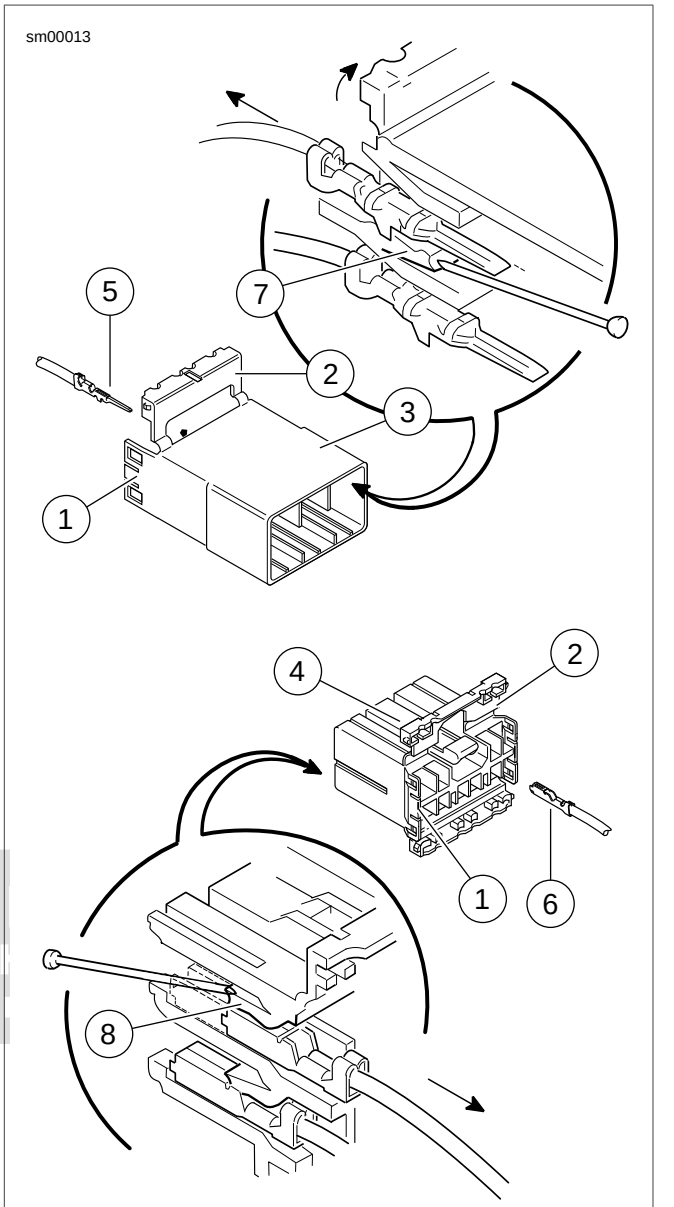
Preparing Wire Leads for Crimping

1. Strip 5/32 in. (4.0 mm) of insulation from the wire lead.

2. See Figure A-2 and Figure A-5. Select the pin/socket terminals from the parts catalog and identify the insulation crimp tails (1) and the wire crimp tails (2) and the groove for the crimp tool locking bar (3).
3. Identify the wire lead gauge and the corresponding crimper tool and nesting die. Refer to Table A-1.

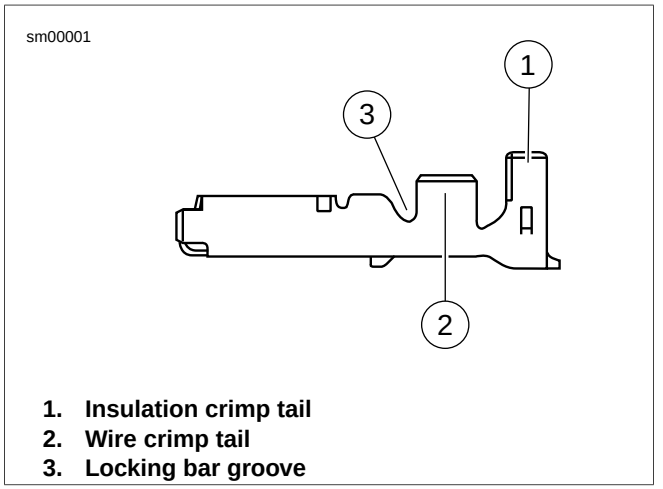
Table A-1. AMP Multilock Connector: Crimp Tool Wire Gauge/Nest

WIRE GAUGE	NEST
20	Front
16	Middle
18	Rear



1. **Latch**
2. **Secondary lock open**
3. **Pin housing**
4. **Socket housing**
5. **Pin terminal**
6. **Socket terminal**
7. **Tang (pin)**
8. **Tang (socket)**

Figure A-4. AMP Multilock Connector: Socket and Pin Housings



1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

Figure A-5. AMP Multilock Connector: Socket Terminal

Crimping Terminals to Leads

NOTE

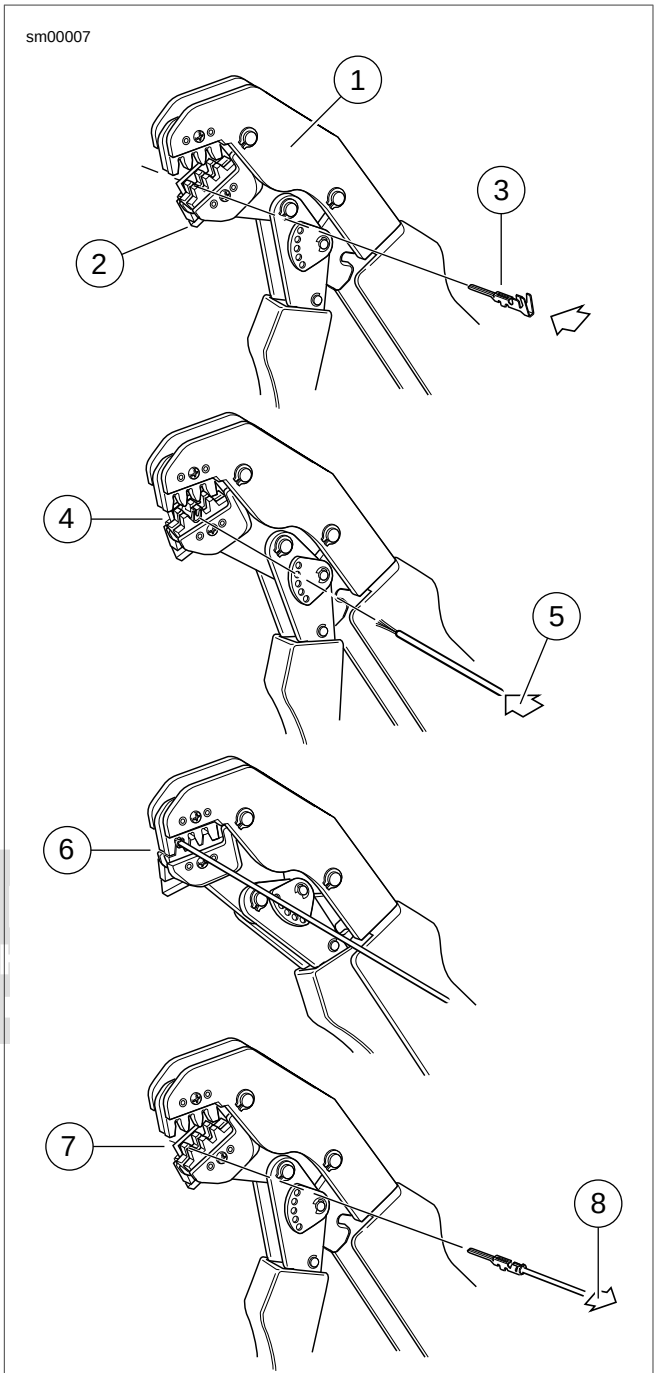
Crimping with an Amp Multilock tool is a one step operation. One squeeze crimps both the wire core and the insulation tails.

1. See Figure A-6. Squeeze the handles to cycle the AMP MULTILOCK CRIMPER (Part No. HD-41609) to the fully open position (1).
2. Raise locking bar by pushing up on bottom flange (2).

NOTE

See Figure A-2 and Figure A-5. Hold the terminal with the insulation crimp tail (1) facing up. The tool will hold the terminal by the locking bar groove (3) and crimp the wire crimp tail (2) around the bare wire of the stripped lead and the insulation crimp tail around the insulation.

3. See Figure A-6. With the insulation crimp tail facing upward, insert terminal (pin or socket) (3) through the locking bar, so that the closed side of the terminal rests on the nest of the crimp tool.
4. Release locking bar to lock position of contact (4). When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
5. Insert stripped end of lead (5) until ends make contact with locking bar.
6. Verify that wire is positioned so that wire crimp tails squeeze bare wire strands, while insulation crimp tails fold over the wire lead insulation.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
8. Raise up locking bar (7) and remove crimped terminal.

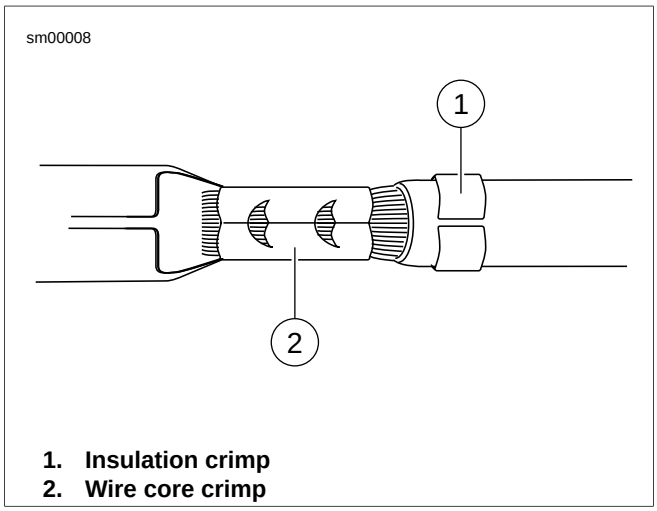


1. **Open position**
2. **Locking bar flange**
3. **Insert contact**
4. **Release locking bar**
5. **Insert lead**
6. **Squeeze**
7. **Raise locking bar**
8. **Remove crimped terminal**

Figure A-6. AMP Multilock Connector: Terminal Crimping Procedure

Inspecting Crimped Terminals

See Figure A-7. Inspect the wire core crimp (2) and insulation crimp (1). Distortion should be minimal.



1. **Insulation crimp**
2. **Wire core crimp**

Figure A-7. AMP Multilock Connector: Terminal Crimp

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DELPHI CONNECTORS A.2

DELPHI CONNECTOR REPAIR

General

Delphi connectors are embossed with the brand name, Delphi, on the housing latch.

Separating Pin and Socket Housings

See Figure A-8. Bend back the external latch(es) slightly and separate pin and socket halves of connector.

Mating Pin and Socket Housings

Push pin and socket halves of connector together until external latch(es) engage.

Removing Socket Terminals

NOTE

Although the parts of the different Delphi connectors vary in appearance, the instructions which follow will work for all. The only exception is the oil pressure sender connector [139B], the terminals of which are removed like the Packard push-to-seat connectors. Therefore, see A.9 150 METRI-PACK CONNECTORS to remove/install terminals in this connector.

1. See Figure A-9. If present, free one side of wire lock (1) from ear on wire end of socket housing, then release the other side. Release wires from channels in wire lock and remove from socket housing.
2. Use a fingernail to pry colored terminal lock (2) loose and then remove from mating end of socket housing.
3. Using a thin flat blade, like the unsharpened edge of a hobby knife, gently pry tang (3) outward away from terminal, and then tug on wire to back terminal out wire end of chamber. Do not pull on wire until tang is released or terminal will be difficult to remove.

Installing Socket Terminals

NOTE

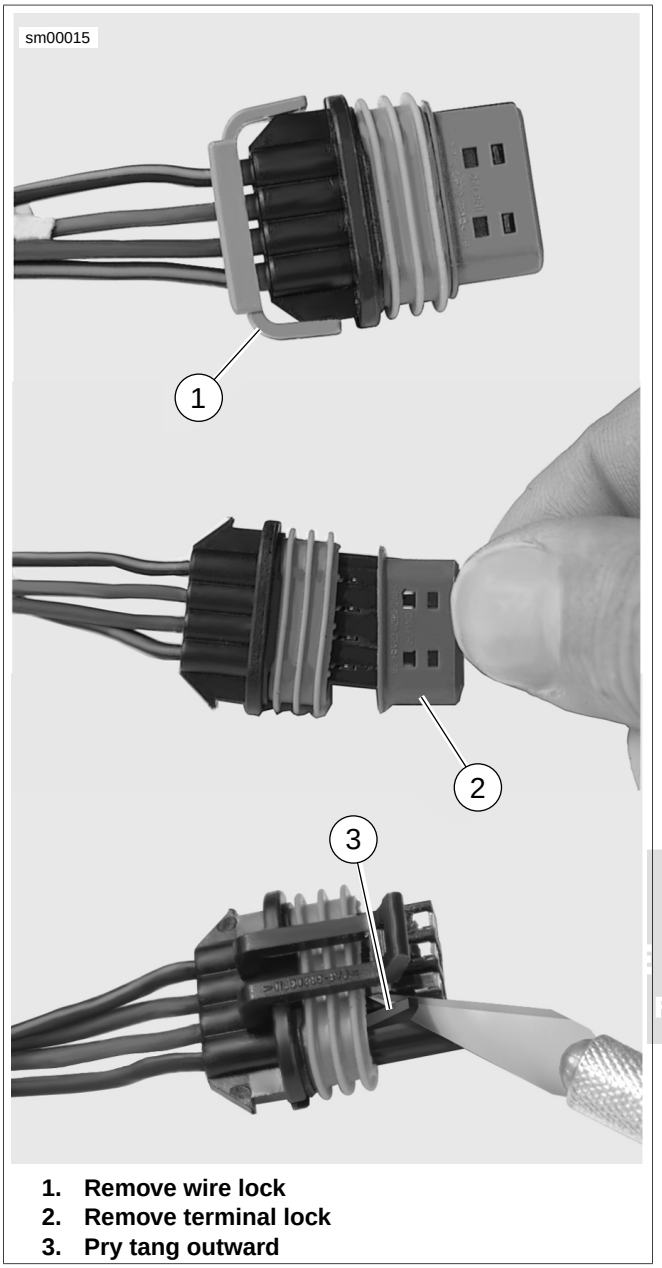
For wire location purposes, alpha or numeric characters are stamped into the wire end of each socket housing.

1. Gently push tang on socket housing inward toward chamber. With the open side of the terminal facing the tang, push terminal into chamber at wire end of socket housing.
2. Gently tug on wire to verify that terminal is locked and will not back out of chamber. If necessary, use fingernail to push tang into engagement with terminal.
3. Install colored terminal lock onto mating end of socket housing.
4. If present, seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.



Figure A-8. Delphi Connector: Socket Housing Latch

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1. **Remove wire lock**
2. **Remove terminal lock**
3. **Pry tang outward**

Figure A-9. Delphi Connector: Removing Socket Terminals

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DEUTSCH 1-PLACE ELECTRICAL CONNECTORS A.3

DEUTSCH 1-PLACE CONNECTOR REPAIR

Separating Pin and Socket Housings

Depress external latch and separate the pin and socket housings of the Deutsch one place connector found on voltage regulators.

Mating Pin and Socket Housings

Orient the housings so the latch faces the catch and push the housings together until it clicks.

Removing Socket Terminals

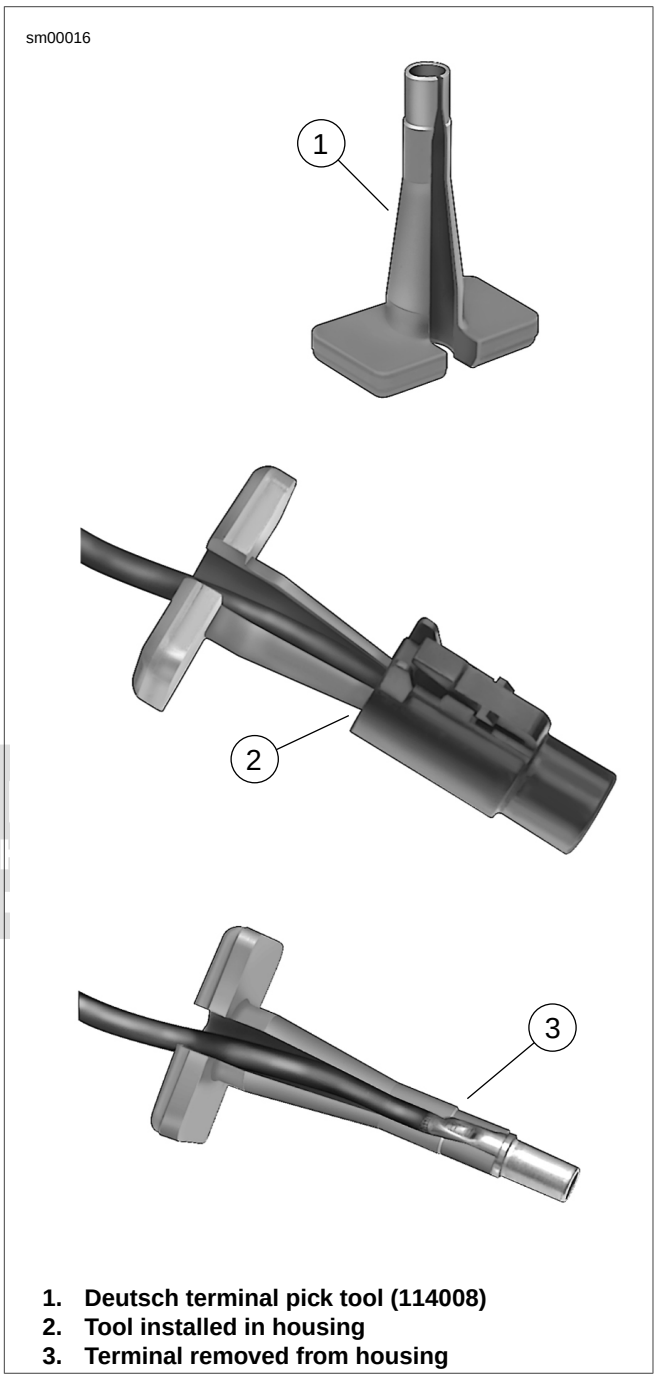
NOTE

Rough handling or careless storage can result in tool damage. Exercise care to avoid cracking or breaking the thin plastic construction.

1. Pull rear wire seal from back of housing and slide down voltage regulator cable to move out of the way.
2. See Figure A-10. Using terminal pick tool (Deutsch® 114008) (1), install tool onto voltage regulator cable so that the tapered end is in the wire end of the housing (2).
3. Push tool into wire end of housing until it bottoms. Gently tug on housing to pull from terminal (3).
4. Remove tool from voltage regulator cable.

Installing Socket Terminals

1. Insert terminal into wire end of housing until it "clicks" in place. Verify that terminal will not back out of housing. A slight tug on the voltage regulator cable will confirm that it is properly locked in place.
2. Fit rear wire seal into back of housing.



1. Deutsch terminal pick tool (114008)
2. Tool installed in housing
3. Terminal removed from housing

Figure A-10. Deutsch 1-Place Connector: Remove Socket/Pin Housing

DEUSCH ELECTRICAL CONNECTORS A.4

DEUTSCH CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41475	DEUTSCH CONNECTOR SERVICE KIT
HD-41475-100	FLAT BLADE L-HOOK

General

Deutsch connectors are colored coded for location purposes. Those connectors associated with **left** side accessories, such as the front and rear **left** turn signals, are **gray**. All other connectors, including those associated with right side accessories, are **black**.

NOTE

A DEUTSCH CONNECTOR SERVICE KIT (Part No. HD-41475) contains a selection of wire seals, internal seals, seal plugs, secondary locking wedges, attachment clips and socket/pin terminals. Also included is a compartmented storage box, carrying case and a FLAT BLADE L-HOOK (Part No. HD-41475-100) is used for the removal of all types of locking wedges.

Separating Pin and Socket Housings

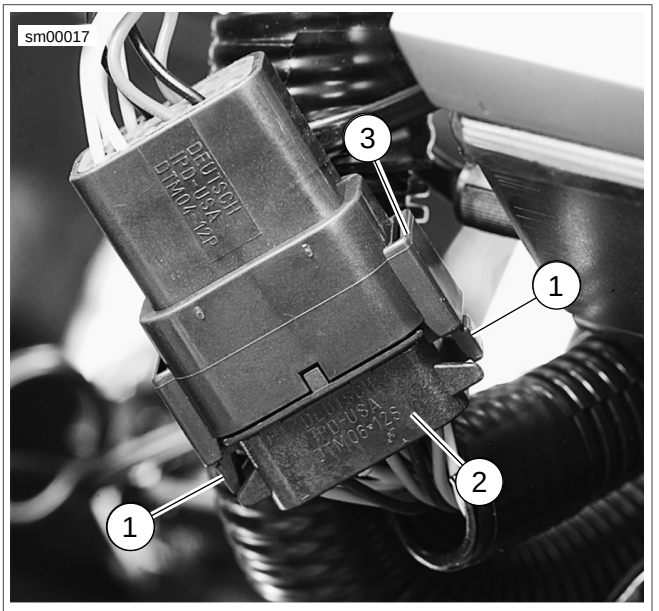
See Figure A-10. To separate the connector halves, depress the external latch(es) (1) on the socket housing (2) while rocking the pin (3) and socket housings.

NOTES

- *Generally, the socket housing is found on the accessory side, while the pin housing is plumbed to the wiring harness.*
- *Two-, three-, four- and six-place Deutsch connectors have one latch on the connector.*
- *Eight- and twelve-place connectors have a latch on each side. Simultaneously press both latches to separate the connector.*

Mating Pin and Socket Housings

1. Align the connectors to match the wire lead colors.
 a. **For One External Latch:** Two-, three-, four- and six-place Deutsch connectors have one external latch on the socket half of the connector. To fit the halves of the connector together, the latch on the socket side must be aligned with the latch cover on the pin side.
 b. **For Two External Latches:** (8-place and 12-place) Align the tabs on the socket housing with the grooves on the pin housing.
2. Insert socket housing into pin housing until it snaps or clicks into place.
 For Two External Latches: (8-place and 12-place) If latches do not click (latch), press on one side of the connector until that latch engages, then press on the opposite side to engage the other latch.
3. If necessary, fit the attachment clip to the pin housing.
4. Place large end of slot on attachment clip over T-stud on frame. Push assembly forward to engage small end of slot.



1. **External latch**
2. **Socket housing**
3. **Pin housing**

Figure A-11. Deutsch Connector

Removing Socket Terminals

1. See Figure A-12. Insert a small screwdriver between the socket housing and locking wedge in-line with the groove (in-line with the pin holes if the groove is absent). Turn the screwdriver 90 degrees to pop the wedge up and remove the secondary locking wedge.
2. See Figure A-15. Use a pick or small screwdriver to depress terminal latches inside socket housing and back out sockets through holes in rear wire seal.

NOTE

*If wire leads require **new** terminals, see the instructions for crimping terminals.*

Installing Socket Terminals

1. Match wire lead color to connector cavity.
2. See Figure A-14. Fit rear wire seal (1) into back of socket housing (2), if removed.
3. Grasp wire lead (3) approximately 1.0 in. (25.4 mm) behind the socket terminal. Gently push socket through hole in wire seal into its chambers until it "clicks" in place.
4. A tug on the wire will confirm that it is properly locked in place.

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NOTE

Seal plugs (6) are installed through the wire seals of unused chambers. If removed, seal plugs must be replaced to seal the connector.

5. Install internal seal (4) on lip of socket housing, if removed.
6. Insert tapered end of secondary locking wedge (5) into socket housing and press down until it snaps in place. The wedge fits into the center groove within the socket housing and holds the terminal latches tightly closed.

NOTES

- *See Figure A-13. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (1) pointing toward the external latch.*
- *If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the socket housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.*

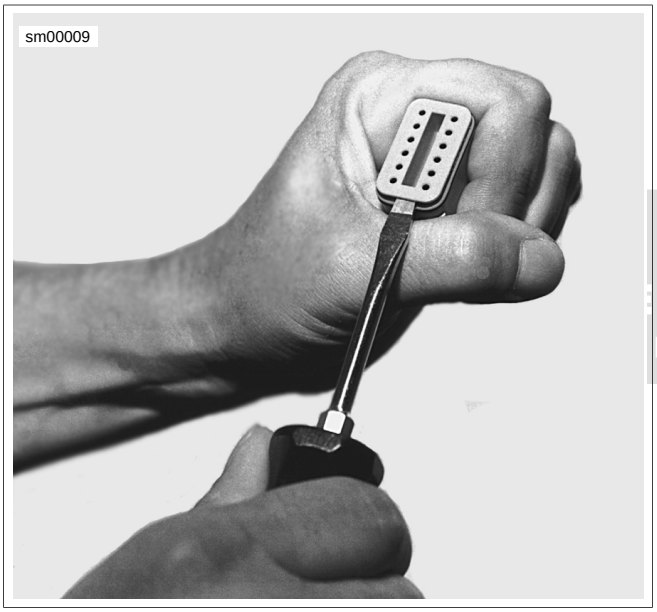
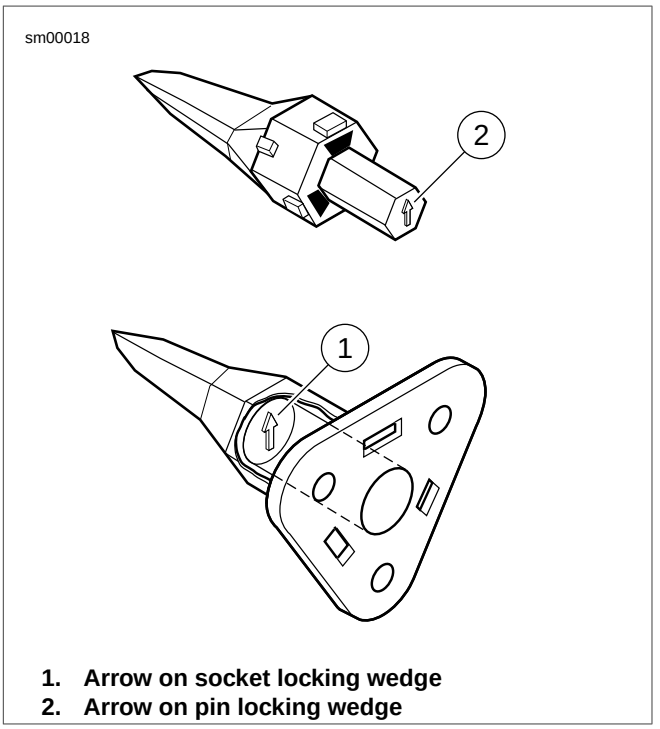


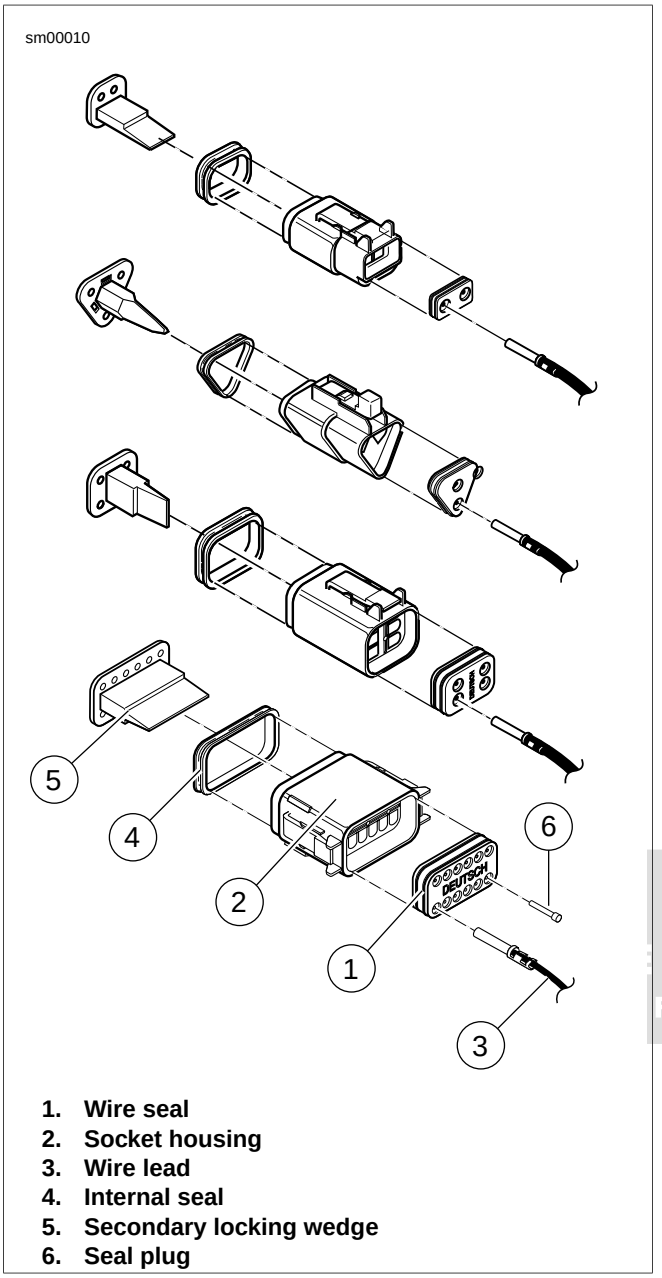
Figure A-12. Deutsch Connector: Remove Secondary Locking Wedge



1. Arrow on socket locking wedge
2. Arrow on pin locking wedge

Figure A-13. Deutsch Connector: 3-Place Locking Wedges

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1. **Wire seal**
2. **Socket housing**
3. **Wire lead**
4. **Internal seal**
5. **Secondary locking wedge**
6. **Seal plug**

Figure A-14. Deutsch Connector: 2, 3, 4 and 12-Place Socket Housings

Removing Pin Terminals

1. Use the hooked end of a stiff piece of mechanics wire, a needle nose pliers or the FLAT BLADE L-HOOK (Part No. HD-41475-100) to remove the secondary locking wedge.
2. Gently depress terminal latches inside pin housing and back out pins through holes in wire seal.

NOTES

- *If wire leads require **new** terminals, see the instructions for crimping terminals.*
- *If it should become necessary to replace a pin or socket housing, please note that the 8-place and 12-place gray and black connectors are not interchangeable. Since location of the alignment tabs differ between the black and gray connectors, plugs or receptacles must be replaced by those of the same color.*
- *When replacing both socket and pin housings, then the black may be substituted for the gray, and vice versa. The socket and pin housings of all other connectors are interchangeable, that is, the black may be mated with the gray, since the alignment tabs are absent and the orientation of the external latch is the same.*

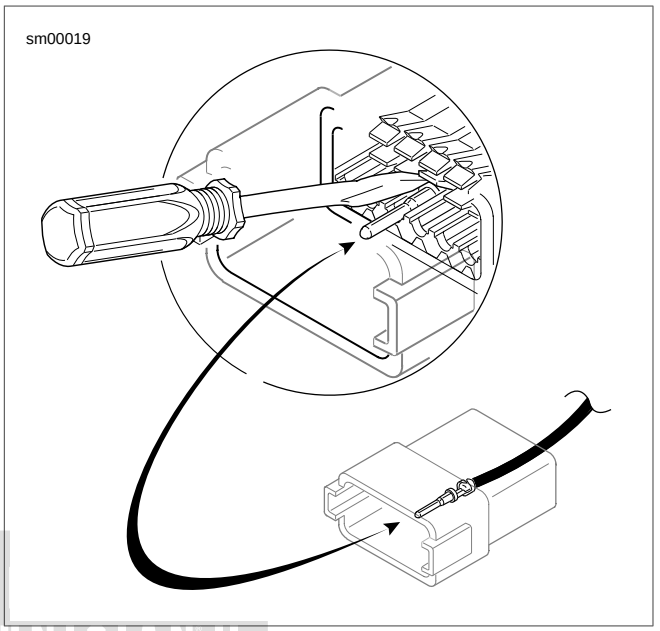


Figure A-15. Deutsch Connector: Depress Terminal Latch and Back Out Pin

Installing Pin Terminals

1. See Figure A-16. Fit wire seal (1) into back of pin housing (2).
2. Grasp wire lead approximately 1.0 in. (25.4 mm) behind the pin terminal (3). Gently push pin through holes in wire seal into its respective numbered chamber until it "clicks" in place.

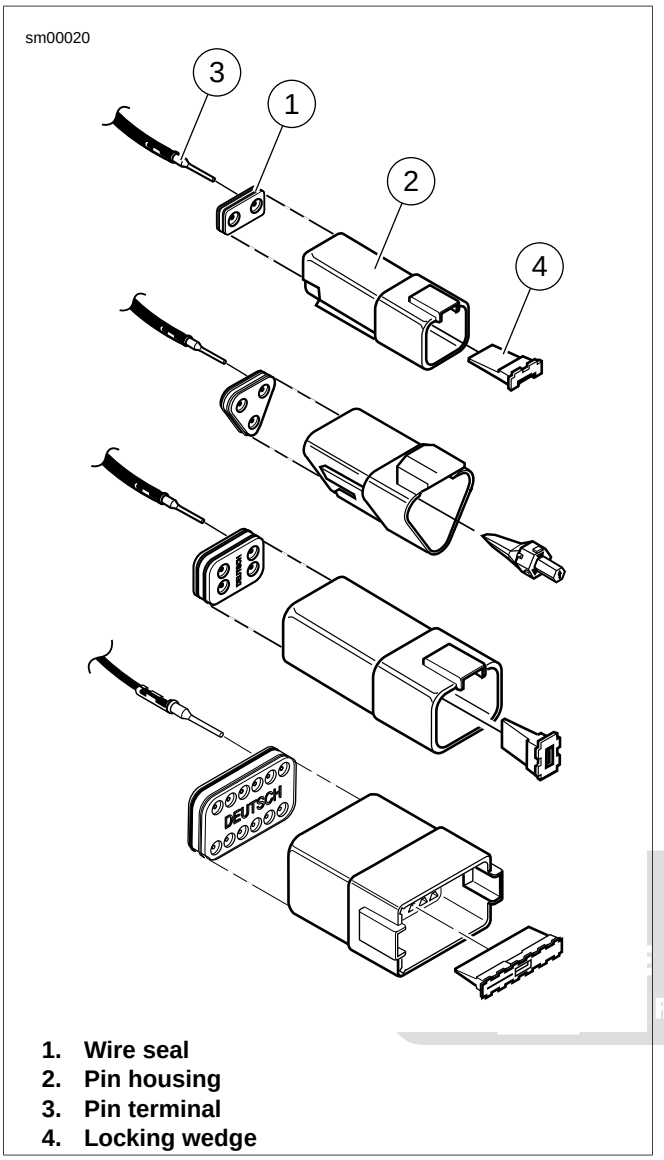
NOTE

A tug on the wire lead will confirm that a pin is locked in place.

3. Insert tapered end of secondary locking wedge (4) into pin housing and press down until it snaps in place.

NOTES

- *The wedge fits in the center groove of the pin housing and holds the terminal latches tightly closed.*
- *See Figure A-13. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (2) pointing toward the external latch.*
- *If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the pin housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.*



1. **Wire seal**
2. **Pin housing**
3. **Pin terminal**
4. **Locking wedge**

Figure A-16. Deutsch Connector: 2, 3, 4 and 12-Place Pin Housings

Crimping Terminals

Identify which of the types of Deutsch terminals are used with the connector and follow the corresponding crimping instructions. Refer to Table A-2.

Table A-2. Deutsch Connector: Terminal Crimping Instructions

TYPE	CRIMPING INSTRUCTIONS
Standard (with crimp tails)	A.5 DEUTSCH STANDARD TERMINALS
Mini Terminal (solid barrel)	A.7 DEUTSCH SOLID BARREL TERMINALS
Mini Terminal (with crimp tails)	A.6 DEUTSCH MINI-TERMINAL CRIMPS

DEUTSCH STANDARD TERMINALS A.5

DEUTSCH STANDARD TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL

Preparing Wire Leads for Crimping

1. Use a shop gauge to determine gauge of wire lead.
2. Strip lead removing 5/32 in. (4.0 mm) of insulation.

Crimping Terminal to Lead

1. See Figure A-17. Squeeze the handles of the DEUTSCH TERMINAL CRIMP TOOL (Part No. HD-39965-A) to open the jaws. Push the locking bar (1) up.
2. Insert (2) terminal (socket/pin) through hole of the locking bar, so that the rounded side of the contact barrel rests in the nest (concave split level area) with the crimp tails facing upward. To match the wire gauge to the crimp tool die, refer to Table A-3.
3. Release locking bar to lock terminal in die.

NOTE

If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the terminal so that the tails face straight upward. When positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.

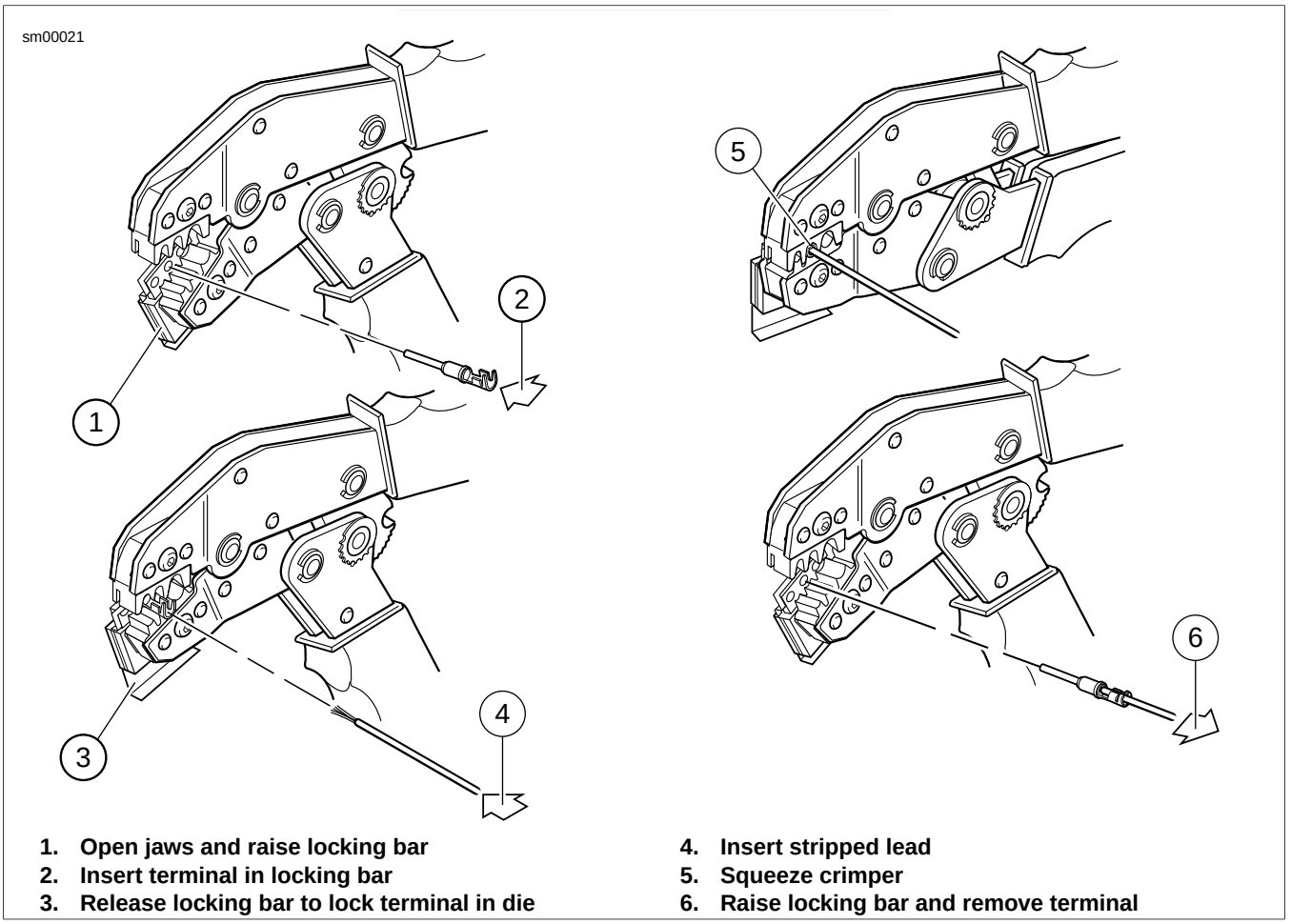
4. Insert stripped wire core between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over the insulation.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens after the terminal is crimped.
6. Raise locking bar up and remove wire lead and terminal.

Inspecting Crimps

Inspect the wire core and insulation crimps. Distortion should be minimal.

Table A-3. Deutsch Standard Terminal Crimp: Wire Gauge To Die

WIRE GAUGE (AWG)	CRIMP TOOL DIE
20	Front
16-18	Middle



1. **Open jaws and raise locking bar**
2. **Insert terminal in locking bar**
3. **Release locking bar to lock terminal in die**
4. **Insert stripped lead**
5. **Squeeze crimper**
6. **Raise locking bar and remove terminal**

Figure A-17. Crimping a Deutsch Standard Terminal

DEUTSCH MINI-TERMINAL CRIMPS A.6

DEUTSCH MINI TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-7	PACKARD TERMINAL CRIMPER

Preparing Wire Leads for Crimping

Strip wire lead removing 5/32 in. (4.0 mm) of insulation.

Crimping a Mini Terminal to Wire Lead

1. See Figure A-18. Compress the handles of PACKARD TERMINAL CRIMPER (Part No. HD-38125-7) until the ratchet (2) automatically opens.

NOTE

Always perform core crimp before insulation crimp.

2. Position the core crimp on die E (1) of the crimper. Be sure the core crimp tails are facing the forming jaws.
3. Gently apply pressure to handles of tool until crimpers just secure the core crimp tails.
4. Insert stripped wire core stands between crimp tails. Position wire so that short pair of crimp tails squeeze bare wire strands, while long pair squeeze over the insulation.
5. Squeeze handle of crimper until tightly closed. Tool automatically opens when the crimping sequence is complete.

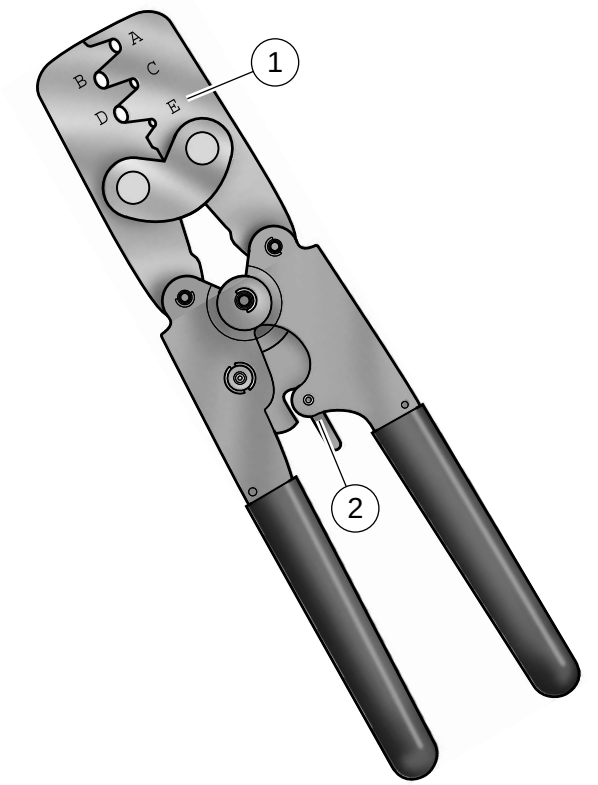
NOTE

If the crimper does not open, it can be opened by squeezing the ratchet trigger (2).

6. Position the insulation crimp on nest C of the crimper. Be sure the insulation crimp tails are facing the forming jaws.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

Inspecting Crimps

Inspect the core and insulation crimps. Distortion should be minimal.



1. E die
2. Crimper ratchet trigger

Figure A-18. Packard Terminal Crimper (HD-38125-7)

DEUTSCH SOLID BARREL TERMINALS A.7

DEUTSCH SOLID BARREL TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-42879	ELECTRICAL CRIMPER TOOL

Preparing Wire Leads For Crimping

For size 20, 16 and 12 contacts, wire ranges 26-12 AWG.

Strip wire lead removing 1/4 in. (6.4 mm) of insulation.

Adjusting Crimper Tool

1. See Figure A-19. Squeeze the ELECTRICAL CRIMPER TOOL (Part No. HD-42879) handles to cycle the crimp tool to open.
2. Remove locking pin (1) from selector knob (2).
3. Raise selector knob and rotate until selected wire size stamped on wheel is aligned with "SEL. NO." arrow (3).
4. Loosen knurled locknut (4) and turn adjusting screw (5) clockwise (in) until it stops.

Crimping a Barrel Contact To Wire Lead

1. See Figure A-20. Turn tool over and drop contact barrel (1) into indentor cover (2) hole with the wire end out.
2. Turn adjusting screw counterclockwise (out) until contact is flush with bottom of depression in indentor cover. Tighten knurled locknut.
3. Slowly squeeze handles of crimp tool until contact is centered between the four indentor points (3).
4. Insert bare wire core strands of stripped wire lead (4) into contact barrel. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
5. Remove wire lead with crimped contact from indentor.

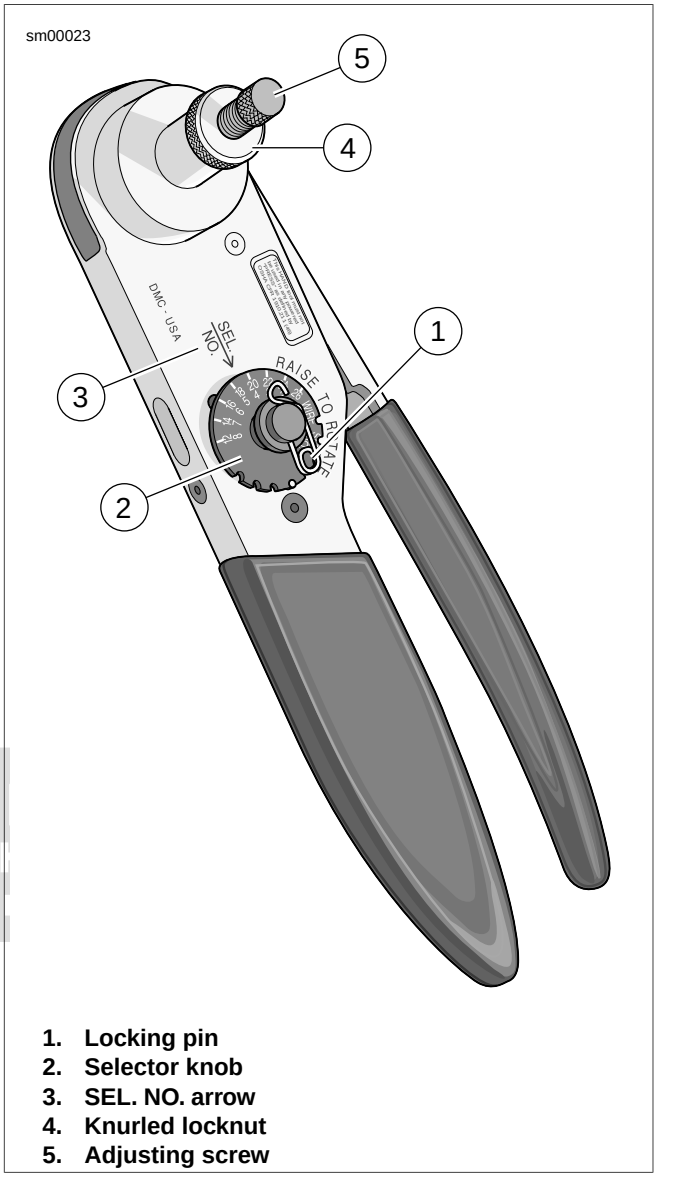
NOTE

Tool must be readjusted when changing contact size/type.

6. Install pin to lock selector knob.

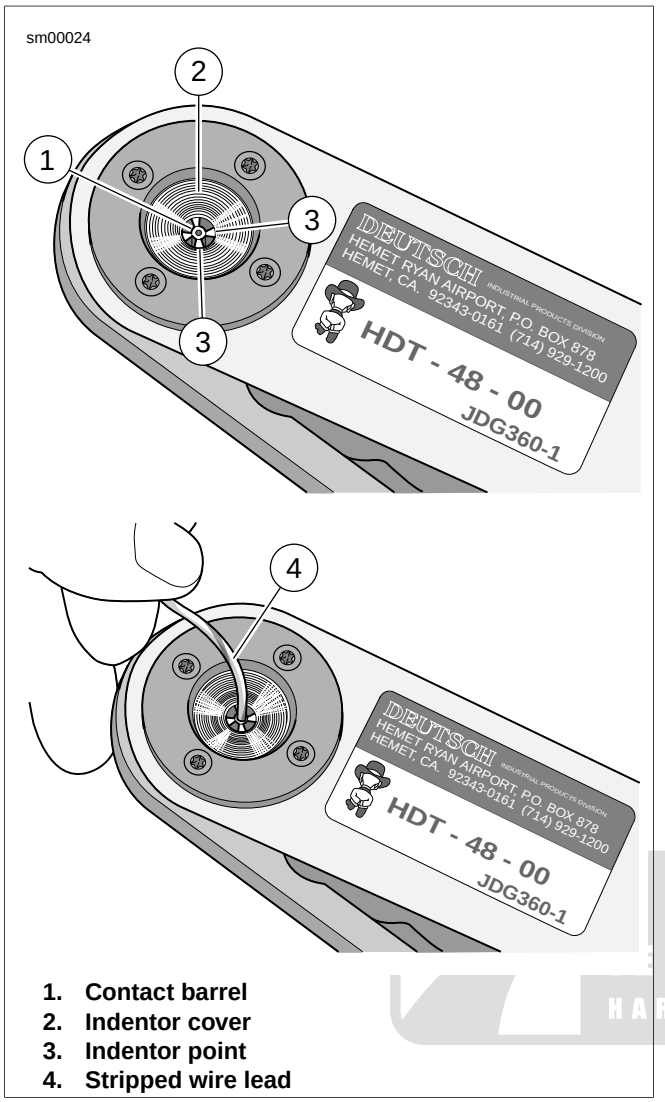
Inspecting Crimps

Inspect the crimp. All core wire strands are to be crimped in the barrel.



1. **Locking pin**
2. **Selector knob**
3. **SEL. NO. arrow**
4. **Knurled locknut**
5. **Adjusting screw**

Figure A-19. Electrical Crimper Tool (HD-42879)



1. **Contact barrel**
2. **Indentor cover**
3. **Indentor point**
4. **Stripped wire lead**

Figure A-20. Deutsch Solid Barrel

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RELAY AND FUSE BLOCKS A.8

FUSE BLOCK REPAIR

Removing Socket Terminals

1. See Figure A-21. To remove secondary locks, insert end of small flat blade screwdriver (1) under lip of locking wedge (2) and gently pry up secondary lock.

NOTE

For best results, start with locking wedge on outboard side of secondary lock.

2. Looking into chamber at top of fuse block, note the tang next to each socket terminal.
3. Using a thin flat blade, like that on a hobby knife, gently push tang away from terminal, and then tug on wire to back terminal out.

Installing Socket Terminals

1. Match the wire lead color to the fuse block terminal cavity.

NOTES

- *Refer to the main harness wiring diagram for wire lead color codes.*
- *See Figure A-22. The main fuse block terminal cavity is identified as alpha (1) and numeric (2) coordinates. Refer to the main harness wiring diagram for fuse block terminal cavity coordinates.*

2. With the open side of the socket terminal facing the tang, push lead into chamber at the wire end of the fuse block. A click is heard when the terminal is properly engaged.
3. Gently tug on the wire to verify that the terminal is locked in place and will not back out of the chamber.
4. Install the secondary locks. With the locking wedges positioned above the tangs in each chamber, slide flat side of secondary lock into slot (between rows), and push down until it bottoms.

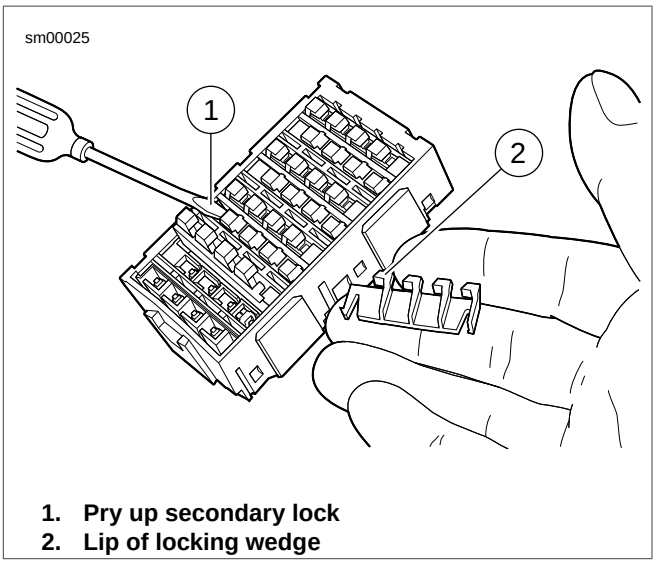
Crimping Terminals

Terminals are crimped twice; once over the wire core and a second time over the insulation/seal.

A correctly crimped terminal may require different crimping dies found on separate crimpers.

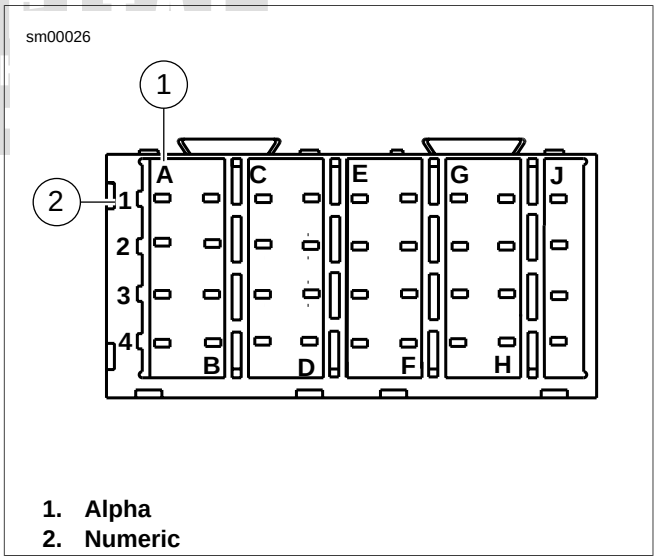
NOTE

The wiring diagram indicates when one socket terminal is be crimped to two wire leads.



1. Pry up secondary lock
2. Lip of locking wedge

Figure A-21. Fuse Block: Remove Secondary Locks



1. Alpha
2. Numeric

Figure A-22. Fuse Block: Coordinates (typical)

150 METRI-PACK CONNECTORS A.9

150 METRI-PACK CONNECTOR REPAIR

General

Metri-Pack connectors are embossed with the initials (P.E.D.).

There are two types of connectors in this series:

- Pull-to-Seat
- Push-to-Seat

Separating Pin and Socket Housings

Bend back the external latch slightly and separate the pin and socket halves of the connector.

Mating Pin and Socket Housings

Align the wire colors and push the pin and socket halves of the connector together.

Removing Socket Terminal

1. See Figure A-23 for pull-to-seat connector or Figure A-24 for push to seat connector. Remove wire lock (1) from wire end of socket housing on push-to-seat type connectors.

NOTE

For best results, free one side of wire lock first and then release the other side.

2. Find the locking tang in the mating end of the connector.

NOTE

The tangs are always positioned in the middle of the chamber and are on the same side as the external latch.

3. Gently insert a safety pin into the chamber about 1/8 in. (3.2 mm).
 a. **For pull-to-seat:** Stay between the terminal and the chamber wall and pivot the end of the pin toward the terminal body.
 b. **For push-to-seat:** There is a small opening for the pin.
4. When a click is heard, remove the pin and repeat the procedure.

NOTE

The click is the sound of the tang returning to the locked position as it slips from the point of the pin.

5. Pick at the tang until the clicking stops and the pin seems to slide in deeper than it had previously. This is an indication that the tang has been depressed.

NOTE

On those terminals that have been extracted on multiple occasions, the click may not be heard, but pivot the pin as if the click was heard at least 3 times.

6. Remove the pin.
 a. **For pull-to-seat:** Push on the lead to extract the terminal from the mating end of the connector.
 b. **For push-to-seat:** Pull on the lead to draw the terminal out the wire end.

Inserting Socket Terminal

NOTE

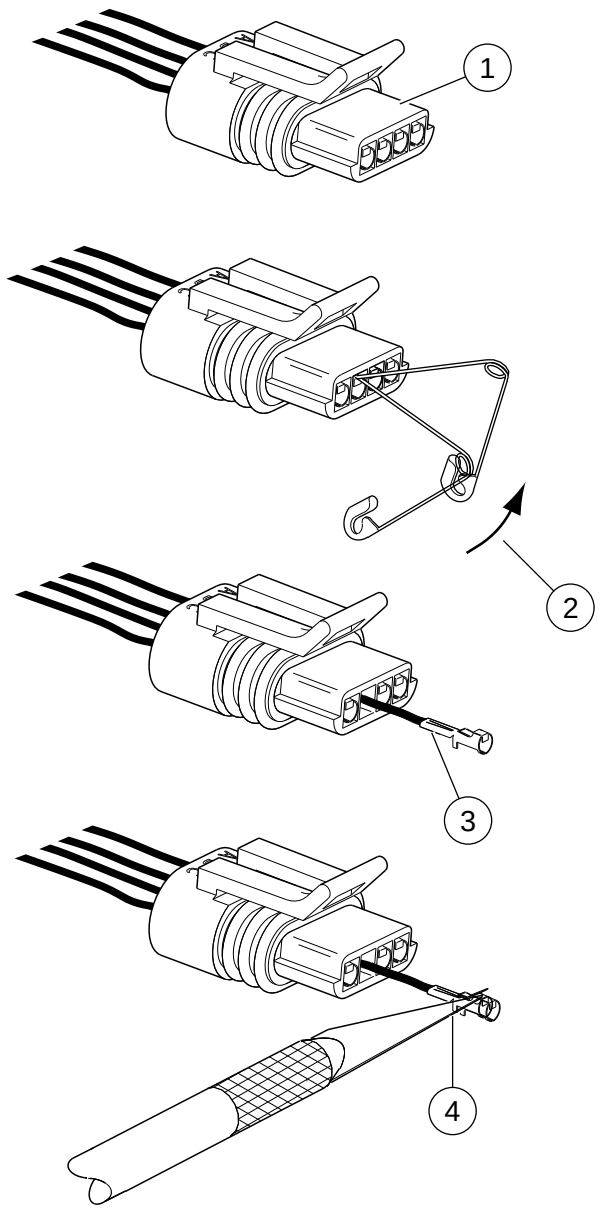
For wire location purposes, alpha characters are stamped into the socket housings.

1. See Figure A-23 for pull-to-seat connector or Figure A-24 for push to seat connector. Using a thin flat blade, like that on a hobby knife, carefully bend the tang outward away from the terminal body.
2. Gently pull or push on the lead to install the terminal back into the chamber. A click is heard when the terminal is properly seated.
3. Gently pull or push on the lead to verify that the terminal is locked in place.

 For push-to-seat: See Figure A-24. Seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.

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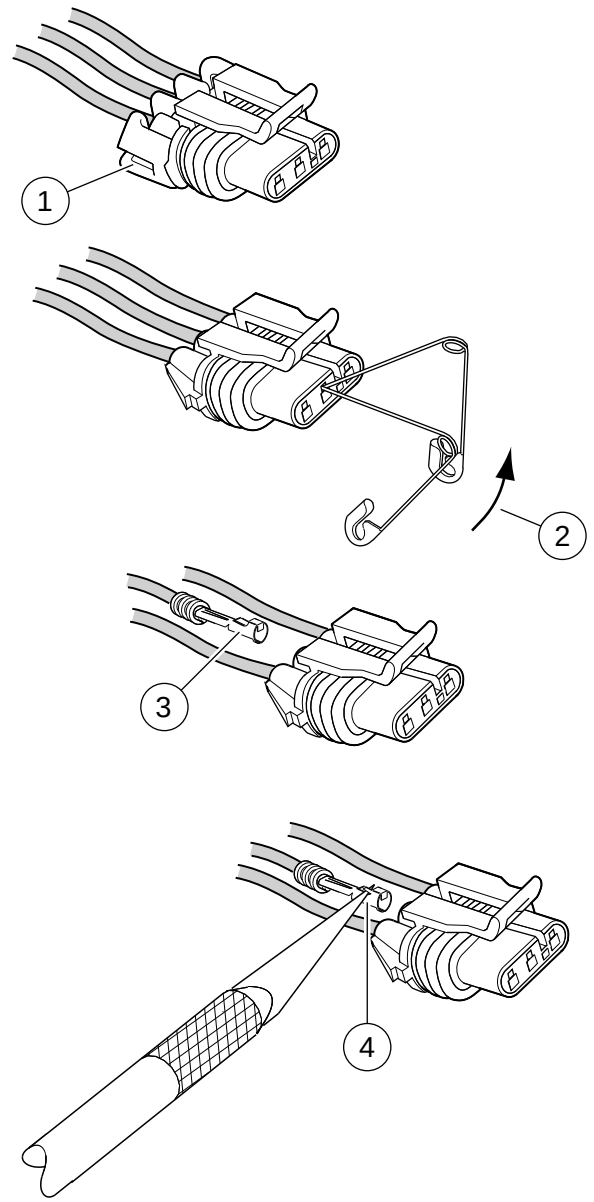
sm00027



1. Locate tang in chamber
2. Pivot pin to depress tang
3. Push to remove
4. Raise tang to install

Figure A-23. 150 Metri-Pack Connector: Pull-to-Seat

sm00028



1. Remove wire lock
2. Pivot pin to depress tang
3. Pull to remove
4. Raise tang to install

Figure A-24. 150 Metri-Pack Connector: Push-to-Seat

280 METRI-PACK CONNECTORS A.10

280 METRI-PACK CONNECTOR REPAIR

General

See Figure A-25. Called Packard connectors, Metri-Pack series connectors are embossed with the initials (P.E.D.)

Separating Pin and Socket Housings

Depress the wireform and use a rocking motion to detach the socket connector half.

Mating Pin and Socket Housings

Align the groove in the socket housing with the tab in the pin housing. Push the pin and socket halves of the connector together until the latch clicks.

Removing Socket Terminals

1. See Figure A-26. Pry rubber seal from wire end of connector and move seal down wires (1) toward conduit. Hold the connector so that the wireform is facing down.
2. Looking into the wire end of the connector, insert the point of a safety pin (2) between the top of the terminal and the inside chamber wall.
3. Push safety pin completely into chamber while watching terminal on mating end of connector. When terminal is observed moving forward slightly, tang is depressed. Remove safety pin.

NOTE

Repeat as necessary until the terminal can be pushed out of the connector.

4. Push on wire end of the lead to extract the terminal from the mating end of the connector.
5. If necessary, crimp new terminals on wires. See A.14 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps.

Installing Socket Terminals

NOTE

Terminal cavities are lettered on the socket housing. To match the wire lead colors to the terminal cavity, refer to the wiring diagram.

1. See Figure A-26. Using a thin flat blade, like a hobby knife (4), carefully bend the tang outward away from the terminal body.
2. Gently pull on the wire lead (5) to draw the terminal back into the chamber. The tang faces opposite the wireform as it enters the chamber.

NOTE

A "click" is heard when the terminal is properly seated.

3. Push on lead to verify that terminal is locked in place.
4. Fit rubber wire seal back into wire end of connector.

Crimping Terminals

If necessary, crimp new terminals on the wire leads. Refer to A.14 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps.

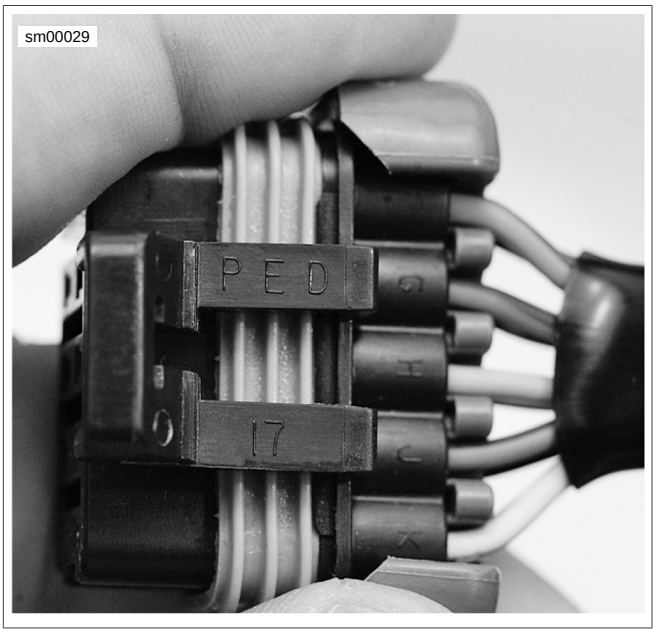
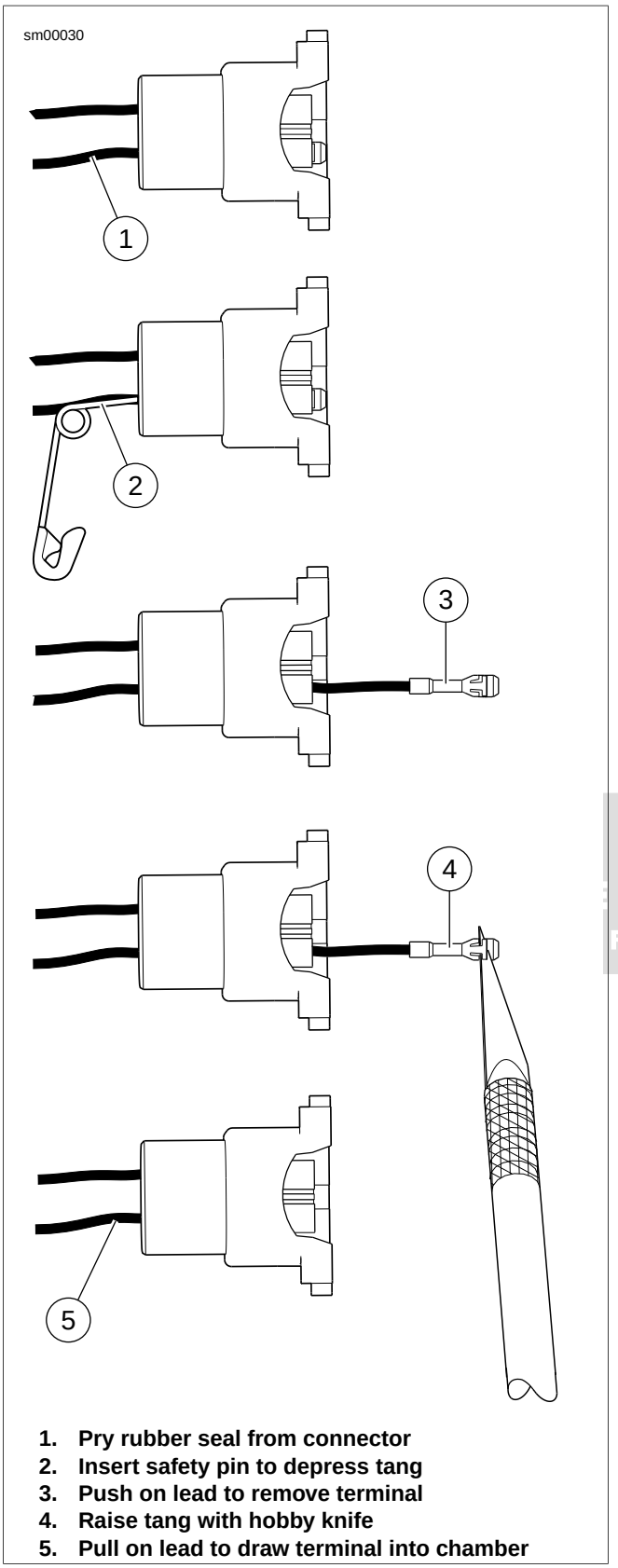


Figure A-25. 280 Metri-Pack Connector (P.E.D.)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Pry rubber seal from connector
2. Insert safety pin to depress tang
3. Push on lead to remove terminal
4. Raise tang with hobby knife
5. Pull on lead to draw terminal into chamber

Figure A-26. 280 Metri-Pack Connector: Remove/Install Socket Terminal

IGITAL
CHNICIAN II
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480 METRI-PACK CONNECTORS A.11

480 METRI-PACK CONNECTOR REPAIR

General

A 480 Metri-Pack (P.E.D.) connector is frequently used for the B+ (battery voltage) connector to power P&A accessories.

Referred to as Packard connectors, Metri-Pack connectors are embossed with the initials P.E.D.

See Figure A-27. An AFL housing (5) is used on many ignition/light switches. The secondary lock (4) must be opened before removing the terminal from the housing.

Separating Pin and Socket Housings

NOTE

Cut any cable strap anchoring the wire conduits of the pin (accessory connector housing) and the socket (B+) housing.

See Figure A-27. Using small flat blade screwdriver, press button (1) on pin housing (red wire) side of the connector and pull apart the pin and socket housings.

Mating Pin and Socket Housings

Orient the latch on the socket housing to the button catch on the pin housing and press the housings together.

Removing Socket Terminals

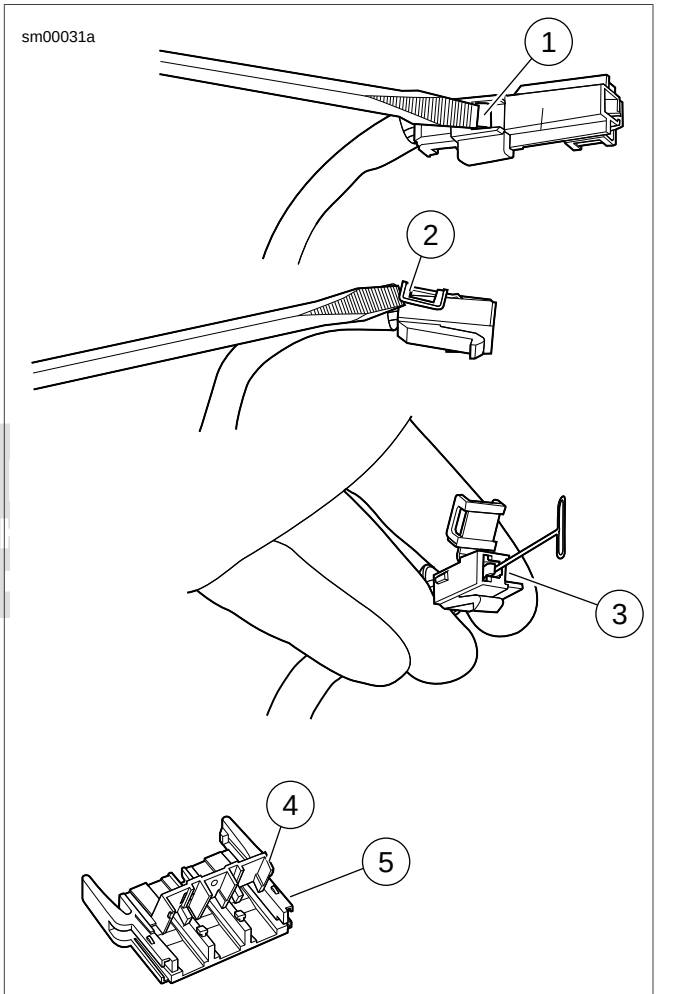
1. See Figure A-27. Bend back the latch (2) slightly and free one side of secondary lock, then repeat to release the opposite side. Rotate the secondary lock outward on hinge to access terminal in chamber of connector housing.
2. On the mating end of the connector, note the tang in the square shaped opening centered next to the terminal. Gently insert the point of a stick pin or large safety pin into the opening (3) between the tang and the chamber wall until it stops.
3. Pivot the end of the pin toward the terminal body to press the tang.
4. Remove the pin and then pull terminal out of the wire end of connector housing.
5. If necessary, crimp **new** terminals on wires. See A.14 METRI-PACK TERMINALS.

Installing Socket Terminals

1. Carefully bend the tang outward away from the terminal body.
2. With the tang on the same side as the square shaped opening in the mating end of the connector housing, feed terminal into wire end of connector housing until it "clicks" in place.
3. Verify that terminal will not back out of the chamber. A slight tug on the cable will confirm that it is locked.
4. Rotate the hinged secondary lock inward until latches fully engage tabs on both sides of connector housing.

NOTE

*If removed, install **new** anchored cable strap in O.E. location. Tighten cable strap to capture conduit of both accessory connector and B+ connector approximately 1.0 in. (25.4 mm) from housings.*



1. **Button on pin housing**
2. **Secondary lock latch**
3. **Opening between tang and chamber wall**
4. **Secondary Lock (shown open)**
5. **AFL housing**

Figure A-27. 480 Metri-Pack Connector: Remove Socket Terminal

630 METRI-PACK CONNECTORS A.12

630 METRI-PACK CONNECTOR REPAIR

PART NUMBER	TOOL NAME
SNAP-ON TT600-3	SNAP-ON PICK

General

Referred to as Packard connectors, Metri-Pack 630 series connectors are embossed with the initials P.E.D.

Separating Pin and Socket Housings

NOTE

If necessary, remove connector from barbed anchor or other retaining device.

Bend back the external latch slightly and separate pin and socket halves of the connector.

Mating Pin and Socket Housings

Orient the latch to the catch and push the pin and socket halves of the connector together until the latch "clicks".

NOTE

If removed, install connector on barbed anchor or other OE retaining device.

Removing Socket Terminal

1. Bend back the latch slightly and free one side of the secondary lock. Repeat the step to unlatch the other side.
2. Rotate the secondary lock outward on hinge to view the terminals in the chambers of the connector housing. The locking tang is on the side opposite the crimp tails and engages a rib in the chamber wall to lock the terminal in place.
3. Moving to the mating end of the connector, take note of the small opening on the chamber wall side of each terminal.
4. Insert SNAP-ON PICK (Part No. SNAP-ON TT600-3) into opening until it stops. Pivot the end of the pick toward the terminal to depress the locking tang.
5. Remove the pick and gently tug on the wire to pull the terminal from the wire end of the connector. Repeat steps if the terminal is still locked in place.
6. If necessary, crimp **new** terminals on wires. Refer to A.14 METRI-PACK TERMINALS.

Installing Socket Terminal

NOTE

Refer to the wiring diagrams to match wire lead colors to alpha characters molded into the secondary locks of each connector housing.

1. Using a thin flat blade, like that of a hobby knife, carefully bend the tang outward away from the terminal body.
2. With the tang facing the chamber wall, push the lead into the chamber at the wire end of the connector. A click is heard when the terminal is properly seated.
3. Gently tug on the wire end to verify that the terminal is locked in place and will not back out of the chamber.
4. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.

DIGITAL TECHNICIAN HARLEY-DAVIDSON

800 METRI-PACK CONNECTORS A.13

DELPHI MAIN FUSE HOUSING REPAIR

General

A Delphi Main fuse connector completes the circuit through the main fuse.

Removing Main Fuse

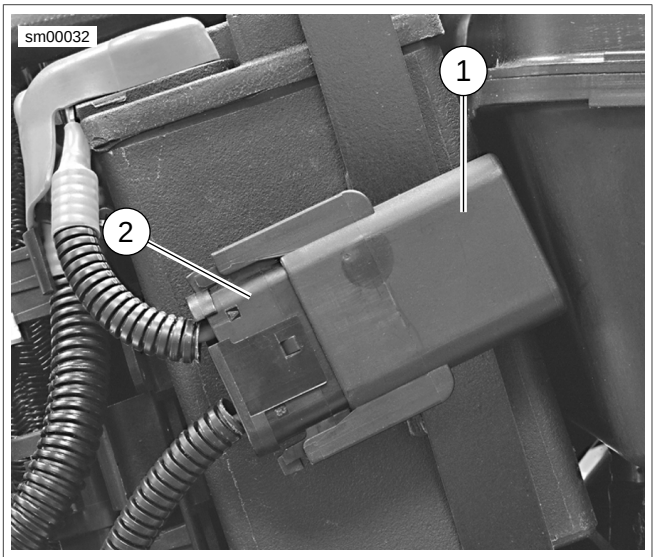
1. See Figure A-28. Depress latches on main fuse cover (1) and then slide cover off of connector (2).
2. Holding the connector (fuse holder), pull the main fuse out of the connector.

Installing Main Fuse

1. Insert the blade terminals of the main fuse into the sockets of the connector and press the main fuse into the connector.
2. Slide the cover over the fuse until the cover clicks into place.

NOTE

If removed from an OE attachment such as a grooved fuse block cover, engage cover and slide into place.



1. **Main fuse cover**
2. **Delphi main fuse housing**

Figure A-28. Delphi Connector Housing: Main Fuse

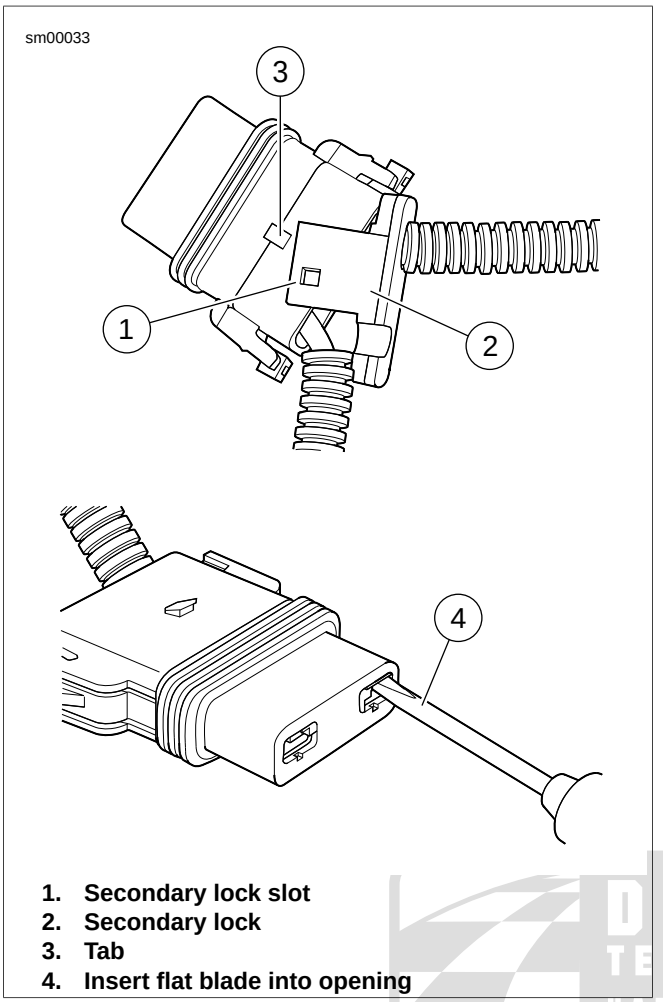
Removing Socket Terminals

1. See Figure A-29. Gently pull socket housing to disengage slots (1) on secondary lock (2) from tabs (3) on socket housing. Free secondary lock from cables and set aside.
2. Take note of the opening on one side of the socket terminal. Gently insert flat blade of pick (Snap-On TT600-5) or small screwdriver into opening (4) until it stops. Pivot the pick toward the terminal body and hold in position.
3. Tug on cable to pull socket from wire end of socket housing. A firm tug is necessary to overcome the resistance of the rubber seal.
4. Repeat to remove remaining socket terminal.

Installing Socket Terminals

1. See Figure A-30. Carefully bend tang outward away from the terminal body.
2. Feed socket into wire end of socket housing until it clicks in place. Verify that socket will not back out of chamber. A slight tug on the cable will confirm that it is locked.
3. Push rubber seal into wire end of socket housing.
4. Repeat to install remaining socket terminal.
5. Install secondary lock onto cables and then push onto wire end of socket housing until slots engage tabs on sides of socket housing.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Secondary lock slot
2. Secondary lock
3. Tab
4. Insert flat blade into opening

Figure A-29. Delphi Main Fuse Housing: Remove Socket Terminals

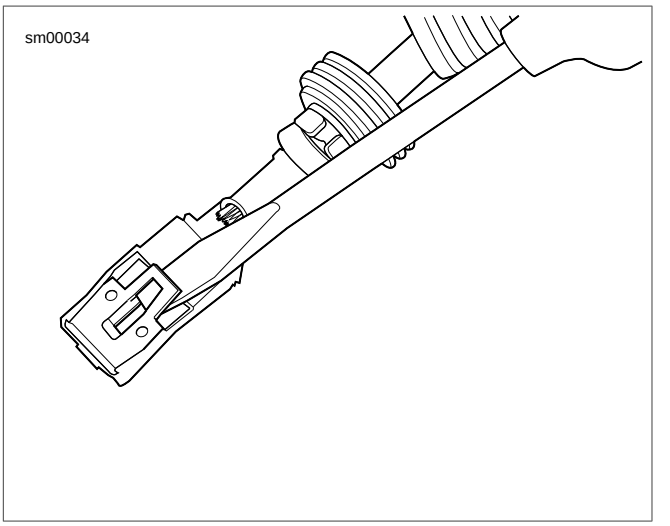


Figure A-30. Delphi Main Fuse Housing: Bend Tang

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

METRI-PACK TERMINALS A.14

METRI-PACK TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-6	PACKARD TERMINAL CRIMP TOOL
HD-38125-7	PACKARD TERMINAL CRIMPER
HD-38125-8	PACKARD CRIMPING TOOL

Matching Terminal To Crimper

Metri-Pack connectors embossed with the initials P.E.D. require Packard crimp tools to crimp terminals to wire leads.

Terminals are crimped twice to a wire lead, once over the wire core and a second time over the insulation/seal.

See Figure A-31. A completed crimp may require two different crimping dies found on PACKARD TERMINAL CRIMP TOOL (Part No. HD-38125-6) and/or PACKARD TERMINAL CRIMPER (Part No. HD-38125-7). The terminal (pin or socket) and the wire lead gauge will determine the core crimp die and the insulator/seal die.

NOTE

The PACKARD CRIMPING TOOL (Part No. HD-38125-8) will also crimp sealed splice connectors in wire gauge sizes 18-20, 14-16 and 10-12.

Preparing Wire Lead

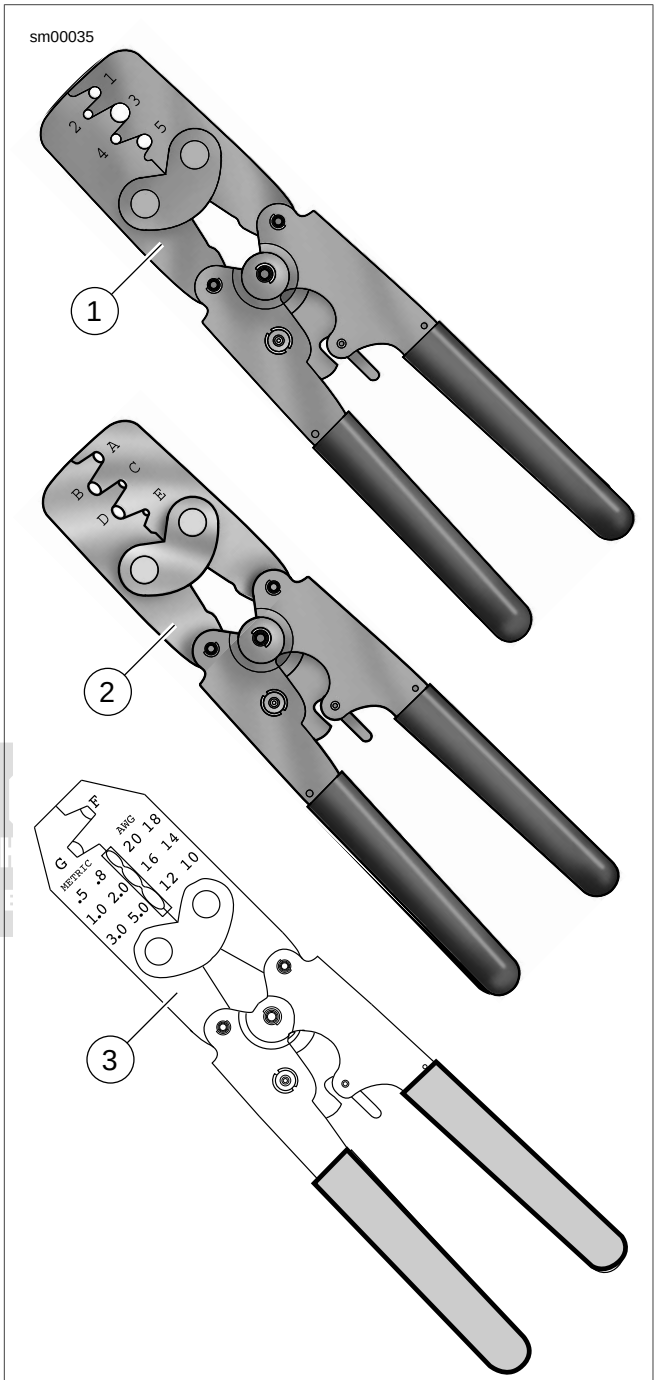
Use a wire striper to strip off the insulation and expose 5/32 in. (4.0 mm) of wire core.

Crimping Wire Core

NOTE

*Metri-Pack terminal crimps require two steps. Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. Squeeze and release handles until ratchet automatically opens.
2. Identify the corresponding sized nest for the core crimp.
3. Position the core crimp in the die. Be Sure the core crimp tails are facing the forming jaws.
4. Gently squeeze the handles until crimpers just secure the core crimp tails.
5. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze core wire strands, while long pair is positioned over the insulation or seal material.
6. Squeeze handles tightly closed. Release grip and the tool will automatically open.



1. **HD-38125-6 sealed terminals**
2. **HD-38125-7 non-sealed terminals**
3. **HD-38125-8 non-sealed terminals**

Figure A-31. Metri-Pack Terminal Crimp Tools

Crimping Insulation/Seal

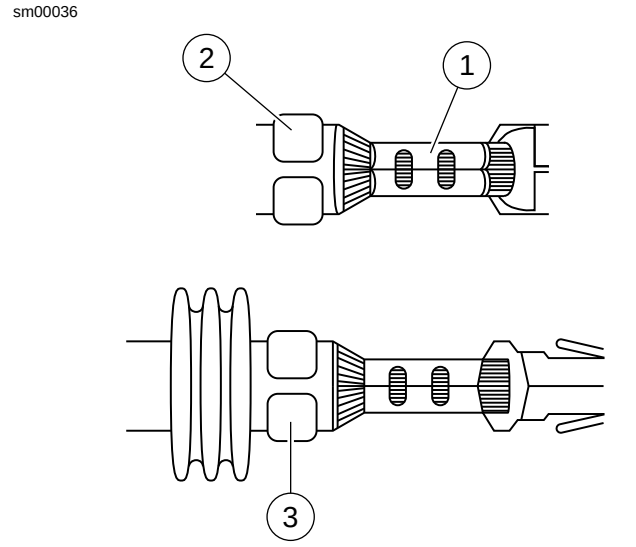
NOTE

*Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. See Figure A-32. Identify the correct die for the insulation/seal crimp (2).
2. Position the insulation/seal crimp in the nest. Be sure the insulation/seal crimp tails are facing the forming jaws.
3. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimp is complete.

Inspecting Crimps

1. See Figure A-32. Inspect the wire core crimp (1). The tails should be folded in on the wire core without any distortion or excess wire strands.
2. Inspect the insulation (2) or seal (3) crimp. The tails of the terminal should be wrapped around the insulation without distortion.



1. **Wire core crimp**
2. **Insulation crimp**
3. **Seal crimp**

Figure A-32. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

MOLEX CONNECTORS A.15

MOLEX CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER

Separating Pin and Socket Housings

See Figure A-33. Depress the latch while pulling the pin and socket housings apart.

Mating Pin and Socket Housings

1. Orient the latch on the pin housing to the latch pocket on the socket housing so the rails on the outside of the pin housings lines up with the tunnels on the socket housing.
2. Press the housings together until the latch clicks.

Removing Terminals

1. Pull the secondary lock up, approximately 3/16 in. (4.8 mm), until it stops.
 a. **Socket Housing:** See Figure A-34. Use a small screwdriver in the pry slot. The slot next to the external latch provides a pivot point.
 b. **Pin Housing:** See Figure A-35. Use needle nose pliers to engage the D-holes in the center of the secondary lock.

NOTE

Do not remove the secondary lock from the connector housing.

2. See Figure A-36. Insert MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER (Part No. HD-48114) into the pin hole next to the terminal until the tool bottoms.
 a. **Socket Housing:** The pin holes are inside the terminal openings.
 b. **Pin Housing:** The pin holes are outside the pins.
3. Pressing the terminal remover to the bottom of the pin hole, gently pull on the wire to remove wire terminal from its cavity.

Installing Terminals

1. See Figure A-37. From the wiring diagram, match the wire color to its numbered terminal cavity.

NOTE

Cavity numbers (1) are stamped on the housing at the ends of the cavity rows. The cavity number can be determined by counting the cavities up or down along the row from each stamped number.

2. Orient the terminal so that the tang (2) opposite the open crimp engages the slot (3) in the cavity.
3. Push the terminal into the cavity.
4. Gently tug on wire to verify that the terminal is captured by the secondary lock.
5. With all terminals installed, push the secondary lock into the socket housing to lock the wire terminals into the housing.

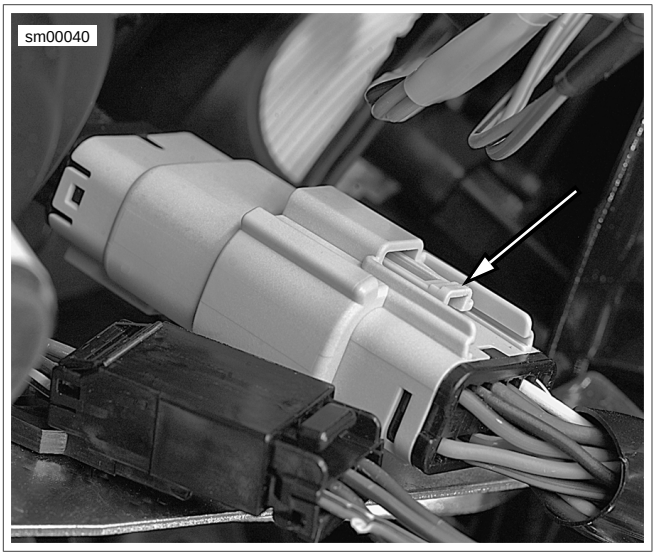


Figure A-33. Molex Connector: Latch

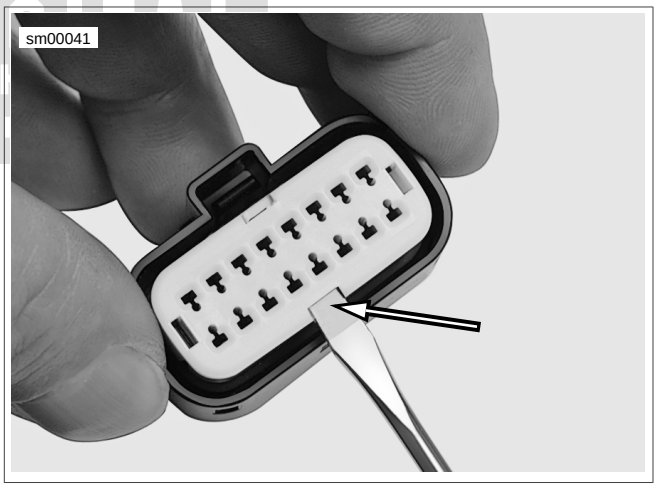


Figure A-34. Molex Connector: Secondary Lock Pry Slot (Socket Housing)

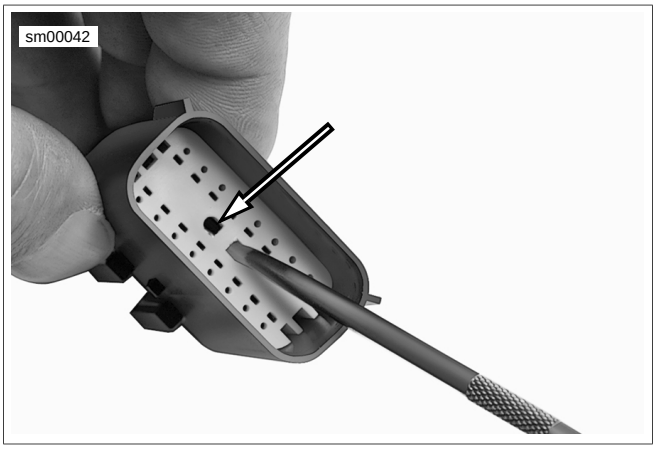


Figure A-35. Molex Connector: Secondary Lock D-Holes (Pin Housing)

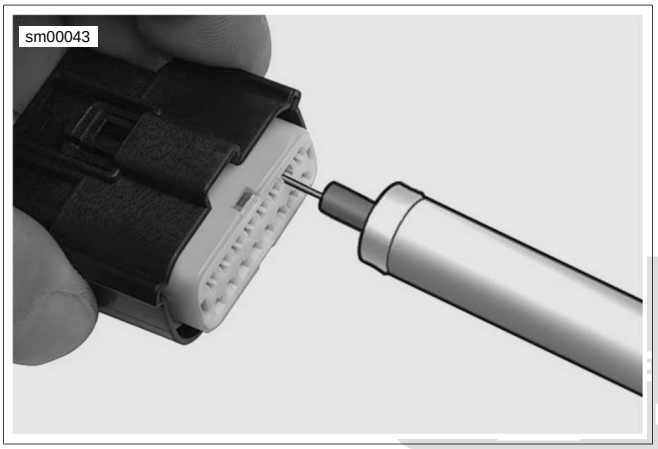
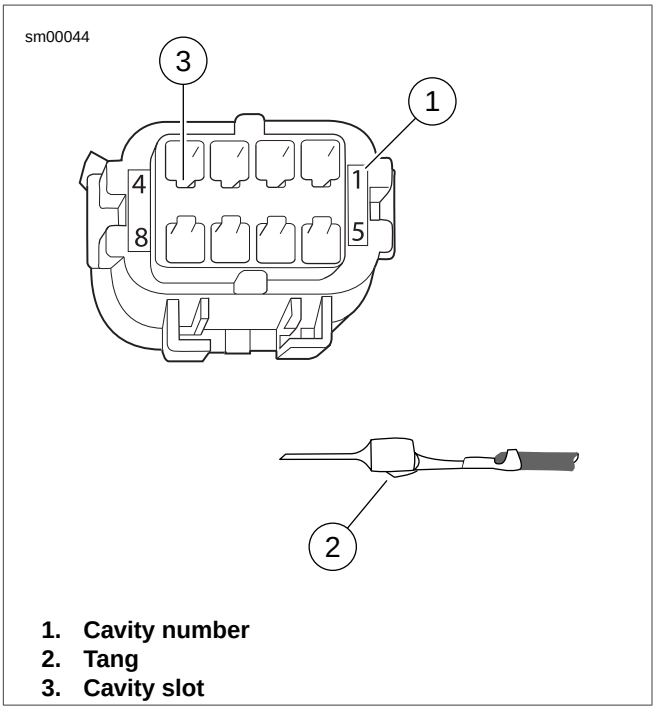


Figure A-36. Molex Connector: Terminal Remover (HD-48114)



1. **Cavity number**
2. **Tang**
3. **Cavity slot**

Figure A-37. Molex Connector: Pin Cavities and Wire Terminal

IGITAL
ECHNICIAN® II
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ECM CONNECTOR A.16

DELPHI 73-TERMINAL ECM CONNECTOR

NOTE

Do not operate latch lever when connector is not mated to ECU. Damage will occur.

Separating Socket Housing From ECM

NOTE

Although this procedure shows the ECM removed, the ECM connector can be removed and installed with the ECM removed or in place.

See Figure A-38. While pressing latch (1), rotate lock lever to the released position (2).

Mating Socket Housing To ECM

Push the connector into the ECM and rotate lock lever to the locked position.

Socket Terminal

1. Cut cable strap to release harness from strain relief collar of connector housing.
2. See Figure A-39. Release latches (4) that retain cover (3) to housing (2) and remove cover.
3. Follow instructions in A.14 METRI-PACK TERMINALS to remove and service the Micro-64 terminals.
4. Install connector housing cover. Verify all wires are within the confines of the cover and that the cover latches are engaged.
5. Install **new** cable strap cable to the strain relief of the connector.

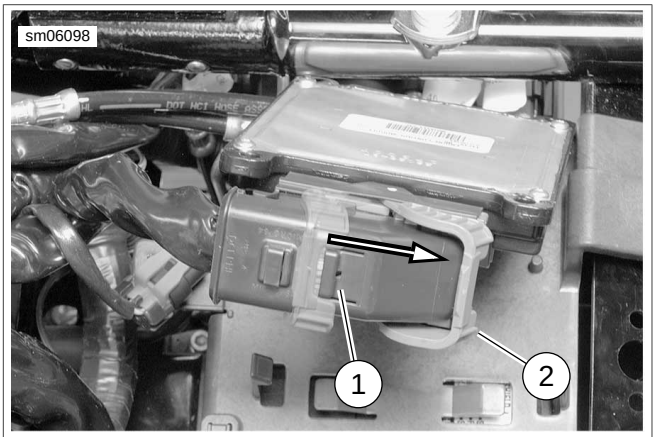
ECM Ground Terminal

1. See Figure A-39. Remove secondary lock (1).
2. See Figure A-40. Using a thin blade screwdriver, gently pry ground terminal retainer from connector housing.
3. See Figure A-41. Using a thin blade screwdriver, release latch and pull ground wire, wire seal and terminal from cover side of housing.
4. Follow instructions in A.14 METRI-PACK TERMINALS to replace the terminal or wire seal.
5. Push the terminal into place from the cover side of the connector housing until the latch engages. Pull on wire to verify terminal is secure.

NOTE

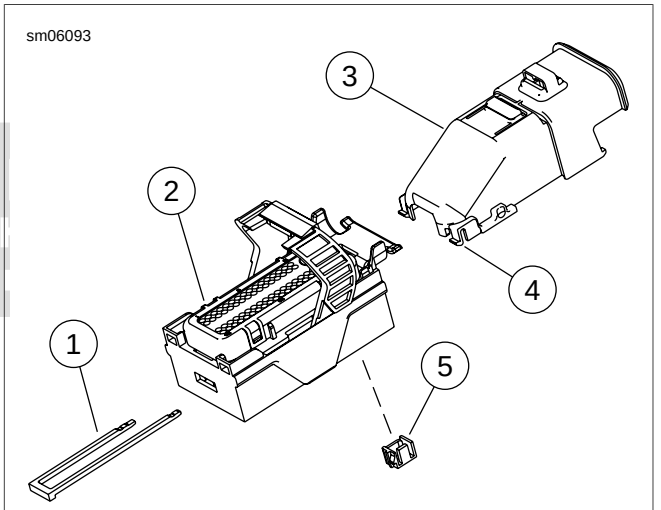
Secondary lock has one short leg and one long leg. Be sure to install correctly as shown in Figure A-39.

6. See Figure A-39. Install ground secondary lock (5) and install secondary lock (1) as shown.



1. **Latch**
2. **Lock lever released**

Figure A-38. Unlatch ECM Connector



1. **Secondary lock**
2. **Terminal housing**
3. **Cover**
4. **Cover latch**
5. **Ground secondary lock**

Figure A-39. Delphi 73-Terminal ECM Connector

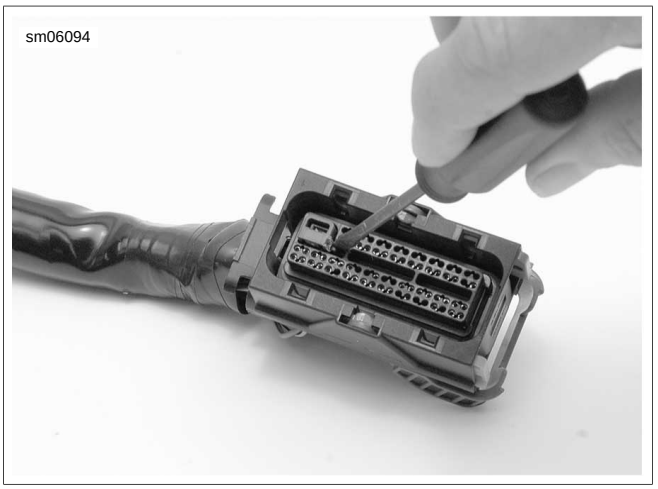


Figure A-40. Remove Ground Secondary Lock

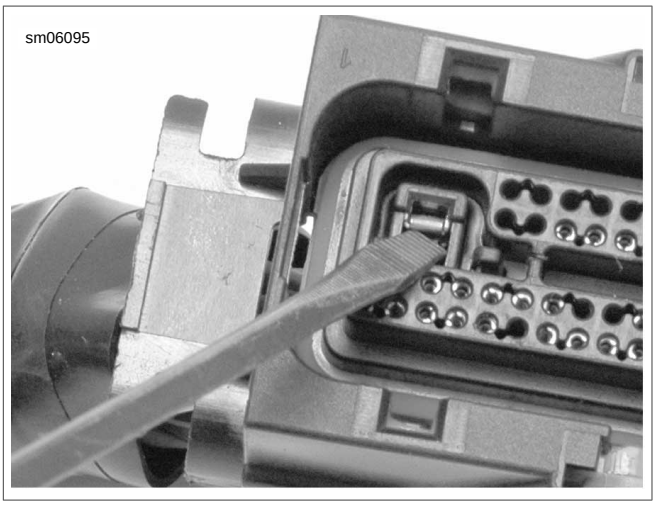


Figure A-41. Remove ECM Ground Terminal

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

PACKARD MICRO-64 CONNECTORS A.17

PACKARD MICRO-64 CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-45928	PACKARD MICRO-64 TERMINAL REMOVER
HD-45929	PACKARD MICRO-64 TERMINAL CRIMPER

General

Packard Micro-64 connectors are frequently found on speedometers, tachometers and the ECM of Touring Models. For pin 73 of these ECMs, see A.9 150 METRI-PACK CONNECTORS.

Separating Pin and Socket Housings

Bend back the external latches slightly and separate the pin and socket housings.

Mating Pin and Socket Housings

Orient the wire lead colors and push the pin and socket housings of the connector together until the latches click.

Removing Terminal

1. See Figure A-44. Locate the head of the secondary lock (1) on one side of the connector housing.
2. Insert the blade of a small screwdriver between the center ear of the lock and the connector housing and gently pry out lock. When partially removed, pull lock from connector housing.
3. Locate pin hole (2) between terminals on mating end of connector.
4. See Figure A-45. Obtain the PACKARD MICRO-64 TERMINAL REMOVER (Part No. HD-45928).
5. See Figure A-43. Push the adjacent terminals all the way into the connector housing and then insert tool into hole until it bottoms.
6. Leaving the tool installed, gently tug on wires to pull either one or both terminals from wire end of connector. Remove tool.

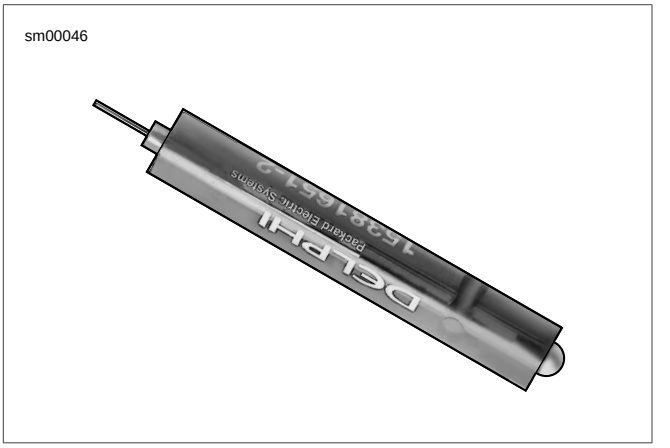


Figure A-42. Packard Micro 64 Terminal Remover (HD-45928)

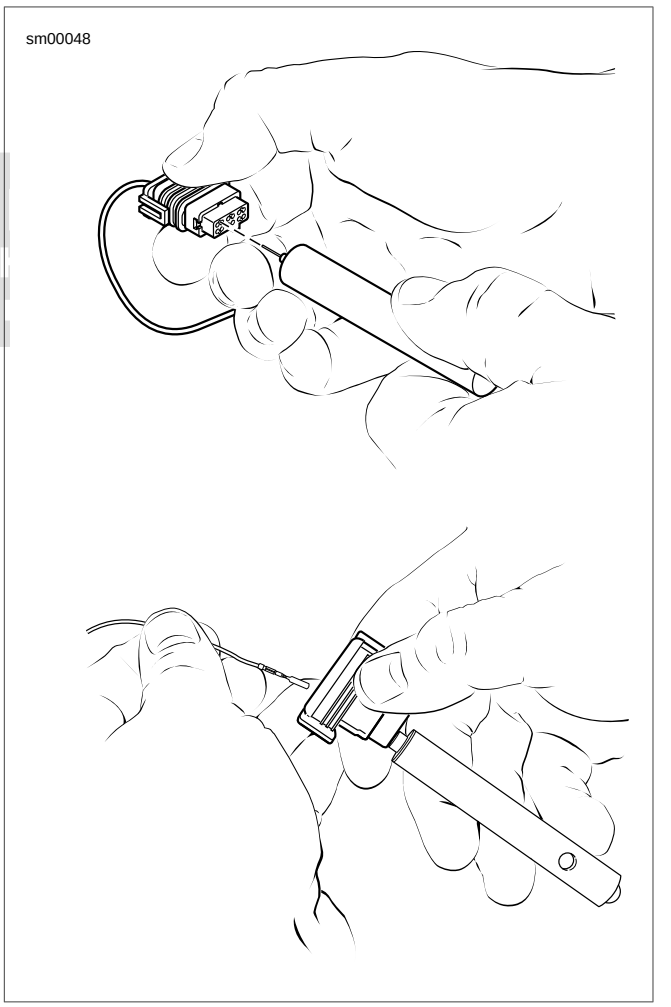


Figure A-43. Packard Micro 64 Connector: Insert Tool and Remove Terminal

Installing Terminal

1. Insert terminal into its respective numbered chamber on wire end of connector. No special orientation of the terminal is necessary.

NOTE

See Figure A-44. For wire location purposes, the corners of the socket housing are stamped (3) with the numbers 1, 6, 7 and 12, representing terminals 1-6 on one side, and 7-12 on the other.

2. Bottom the terminal in the chamber and then gently tug on the wire to verify that it is locked in place.

NOTE

Once the terminal is removed it may not lock in place when first reinstalled. Until the lock engages, move the terminal back and forth slightly while wiggling the lead.

3. Since the terminal remover tool releases two terminals simultaneously, repeat step 2 on the adjacent terminal even if it was not pulled from the connector housing.

4. With the center ear on the head of the secondary lockpin facing the mating end of the connector, push secondary lock in until head is flush with the connector housing.

Preparing Wire Leads for Crimping

Strip lead removing 1/8 in. (3.0 mm) of insulation.

Crimping Terminals

1. Inspect **new** socket terminal for bent or deformed contact and crimp tails. Replace as necessary.

2. See Figure A-46. Squeeze the handles of the PACKARD MICRO-64 TERMINAL CRIMPER (Part No. HD-45929) to cycle the tool to the fully open position (1).

3. Raise locking bar and barrel holder by pushing up on bottom tab with index finger (2).

4. With the crimp tails facing upward, insert terminal through locking bar into front hole in barrel holder (20-22 gauge wire) (3).

5. Release locking bar to lock position of contact. When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails and the closed side of the terminal rests on the outer nest of the crimp tool.

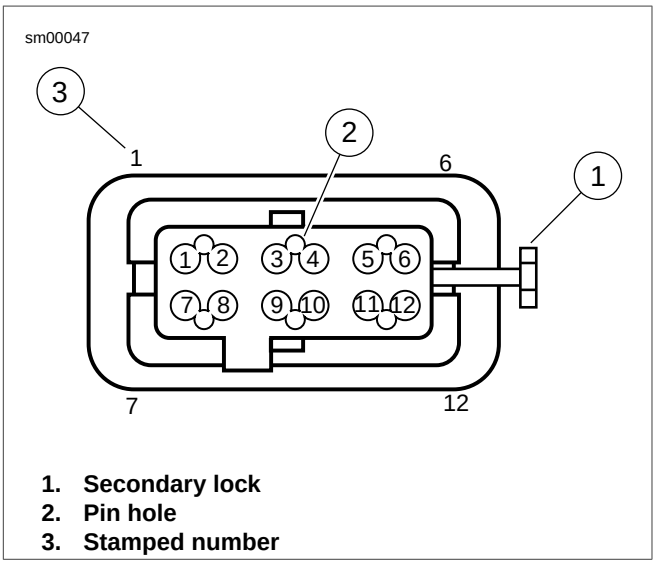
6. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that wide pair of crimp tails squeeze bare wire strands, while the narrow pair folds over the insulation material.

7. Squeeze handle of crimp tool until tightly closed (4). Tool automatically opens when the crimping sequence is complete.

8. Raise locking bar and barrel holder to remove contact.

Inspecting Crimps

Inspect the quality of the core and insulation crimps. Distortion should be minimal.



1. **Secondary lock**
2. **Pin hole**
3. **Stamped number**

Figure A-44. Packard Micro 64 Connector: Housing

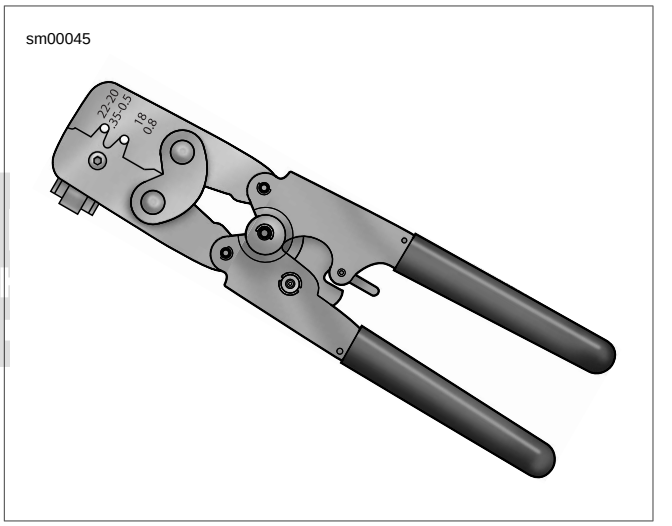
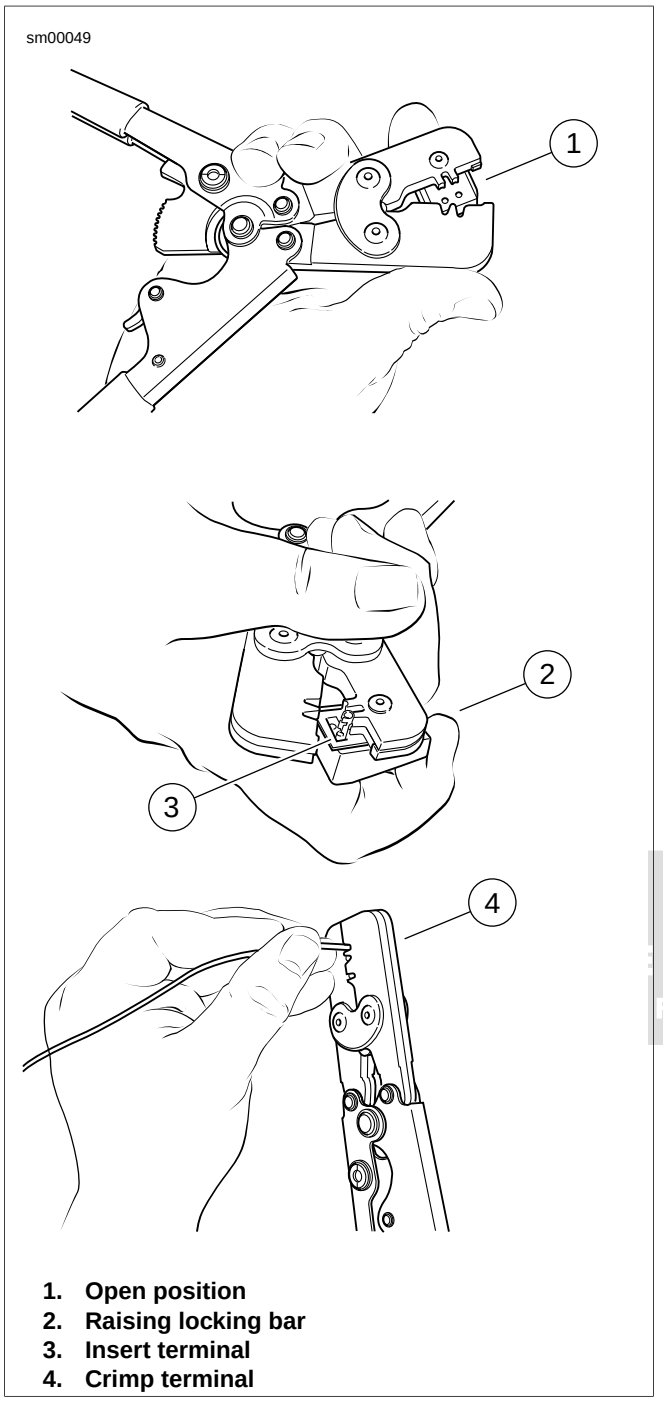


Figure A-45. Packard Micro 64 Terminal Crimper (HD-45929)



1. **Open position**
2. **Raising locking bar**
3. **Insert terminal**
4. **Crimp terminal**

Figure A-46. Packard Micro 64 Connector: Terminal in Crimper

IGITAL
CHNICIAN® II
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SEALED SPLICE CONNECTORS A.18

SEALED SPLICE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-38125-8	PACKARD CRIMPING TOOL
HD-39969	ULTRA TORCH UT-100
HD-41183	HEAT SHIELD ATTACHMENT

General

Splice connectors and several OE ring terminal connectors use heat shrink covering to seal the connection.

Preparing Wire Leads

NOTE

If adjacent wires are to be spliced, stagger the splices so that the sealed splice connectors will not touch each other but are located at different positions along the length of the wires.

1. Using a shop gauge, identify the gauge of the wire.
2. Match the wire gauge to a sealed splice connector by color and part number. Refer to Table A-4.
3. Using a wire stripper, cut and strip a length of insulation off the wire ends. Refer to Table A-4 for the strip length.

Table A-4. Sealed Splice Connectors

WIRE GAUGE	COLOR	PART NO.	STRIP LENGTH
18-20 (0.5-0.8 mm)	Red	70585-93	3/8 in. (9.5 mm)
14-16 (1.0-2.0 mm)	Blue	70586-93	3/8 in. (9.5 mm)
10-12 (3.0-5.0 mm)	Yellow	70587-93	3/8 in. (9.5 mm)

NOTE

If any copper wire strands are cut off of the wire core, trim the end and strip the wire again in a larger gauge stripper.

Splicing Wire Leads

NOTE

See Figure A-48. The connector is crimped twice - one side and then the other.

1. See Figure A-47. Open the PACKARD CRIMPING TOOL (Part No. HD-38125-8) ratchet by squeezing the handles closed.
2. Match the connector color to the wire gauge crimp die in the jaws and insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure A-48. Feed the stripped end of a wire into the connector until the wire stops inside the metal insert (1).
5. Squeeze the handles tightly closed to crimp the lead in the insert (2). The tool automatically opens when the crimping is complete.
6. Slide the connector to the other half of the metal insert. Insert the stripped wire lead (1) until it stops, and crimp the lead in the insert (2).

WARNING

Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

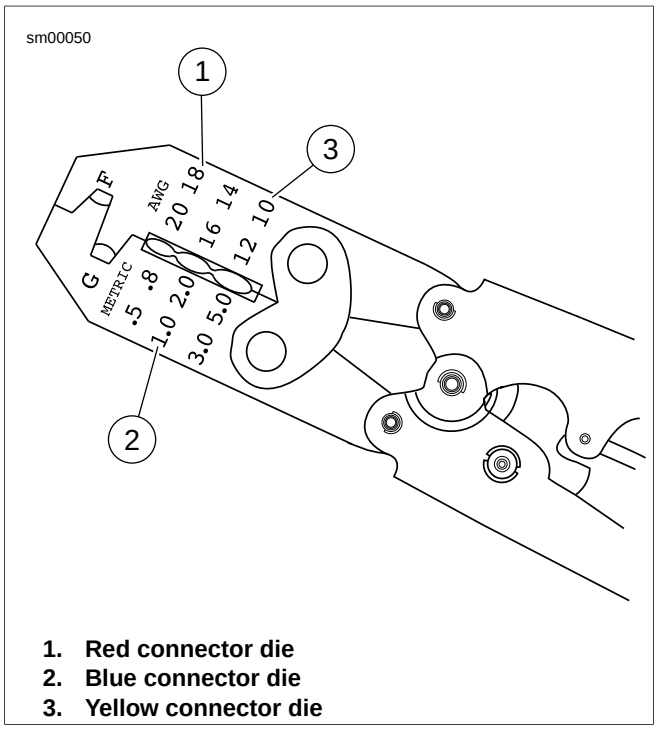
7. Use an ULTRA TORCH UT-100 (Part No. HD-39969), or a ROBINAIR HEAT GUN (Part No. HD-25070) with a HEAT SHIELD ATTACHMENT (Part No. HD-41183), to heat the connector from the center of the crimp (3) out to each end.

NOTE

It is acceptable for the splice to rest against the heat shrink tool attachment.

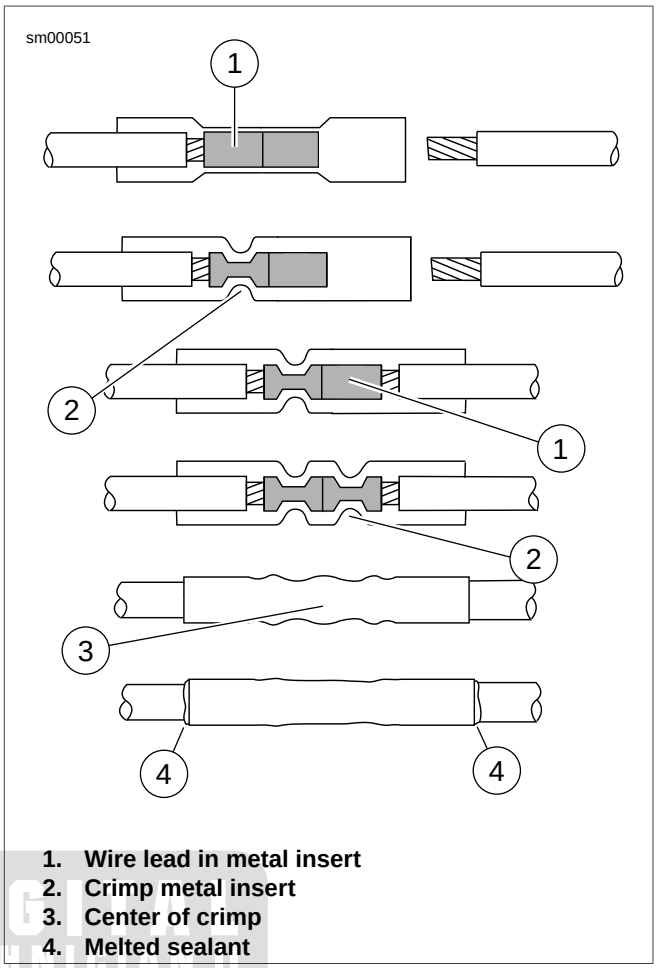
Inspecting Seals

See Figure A-48. Allow the splice to cool and inspect the seal. The insulation should appear smooth and cylindrical. Melted sealant will have extruded out the ends (4) of the insulation.



1. Red connector die
2. Blue connector die
3. Yellow connector die

Figure A-47. Packard Crimping Tool (HD-38125-8)



1. Wire lead in metal insert
2. Crimp metal insert
3. Center of crimp
4. Melted sealant

Figure A-48. Sealed Splice Connector

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TABLE OF CONTENTS

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B.1 CONNECTORS.....B-1
B.2 WIRING DIAGRAMS.....B-19

DIGITAL TECHNICIAN® II
HARLEY-DAVIDSON®

NOTES

CONNECTORS B.1

CONNECTOR LOCATIONS

Function/Location

On the motorcycle, a connector can be identified by its function and location. Refer to Table B-1, Table B-2 or Table B-3.

Place and Color

The place (number of wire cavities of a connector housing) and color of the connector can also aid identification.

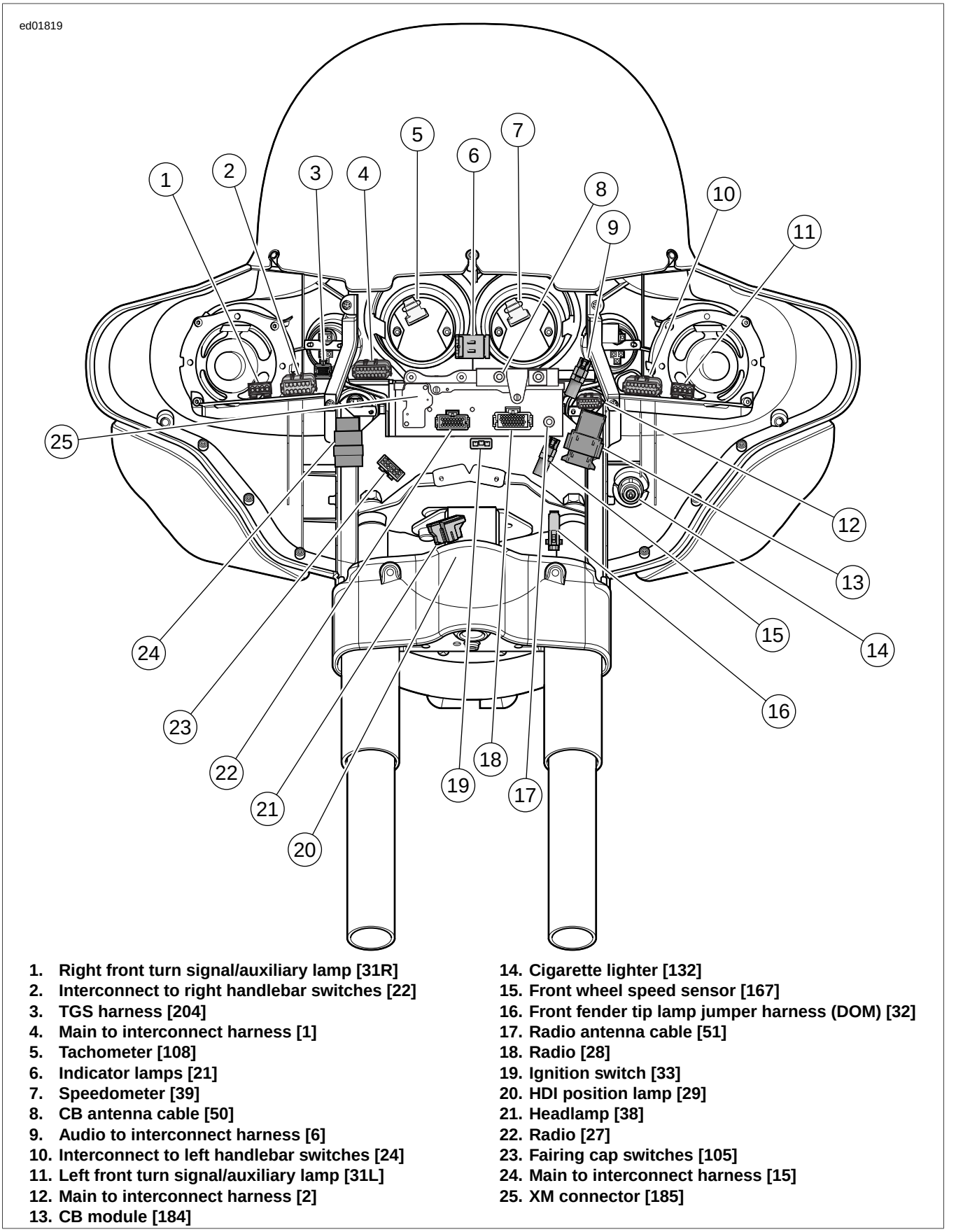
Connector Number

On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets.

Repair Instructions

The repair instructions in this Service Manual are by connector type. Refer to Table B-1, Table B-2 or Table B-3.

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1. Right front turn signal/auxiliary lamp [31R]
2. Interconnect to right handlebar switches [22]
3. TGS harness [204]
4. Main to interconnect harness [1]
5. Tachometer [108]
6. Indicator lamps [21]
7. Speedometer [39]
8. CB antenna cable [50]
9. Audio to interconnect harness [6]
10. Interconnect to left handlebar switches [24]
11. Left front turn signal/auxiliary lamp [31L]
12. Main to interconnect harness [2]
13. CB module [184]
14. Cigarette lighter [132]
15. Front wheel speed sensor [167]
16. Front fender tip lamp jumper harness (DOM) [32]
17. Radio antenna cable [51]
18. Radio [28]
19. Ignition switch [33]
20. HDI position lamp [29]
21. Headlamp [38]
22. Radio [27]
23. Fairing cap switches [105]
24. Main to interconnect harness [15]
25. XM connector [185]

Figure B-1. Inner Fairing Connectors (FLHX, FLHT/C/U)

Table B-1. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	Inner fairing - right radio support bracket
[2]	Main to interconnect harness	12-place Molex (gray)	Inner fairing - left radio support bracket
[4]	Accessory	4-place Deutsch	Under seat
[5]	MAXIFUSE	2-place Packard	Under left side cover
[6]	Audio to interconnect harness	6-place Deutsch (black)	Inner fairing - left side of radio
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[12]	Tour-Pak lights (rear facia lamp on FLHX)	3-place Multilock	Inside Tour-Pak (inboard of upper frame tube on FLHX)
[13]	Fuel tank harness	4-place Multilock	Behind fuel tank (under seat)
[15]	Main to interconnect harness	4-place Delphi	Inner fairing - right fairing bracket
[18]	Left rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[19]	Right rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[21]	Indicator lamps	10-place Multilock	Inner fairing - above radio
[22]	Interconnect to right handlebar switches	12-place Molex (black)	Inner fairing - right fairing support bracket
[24]	Interconnect to left handlebar switches	16-place Molex (gray)	Inner fairing - left fairing support brace
[27]	Radio*	23-place Amp (Tyco)	Inner fairing - back of radio (right side)
[28]	Radio**	35-place Amp (Tyco)	Inner fairing - back of radio (left side)
[29]	HDI position lamp	Spade terminals	Back of headlamp
[30]	TSM/TSSM/HFSM	12-place Deutsch	Under right side cover
[31L]	Left front turn signal/auxiliary lamp	4-place Multilock	Inner fairing - left fairing support brace (outboard side)
[31R]	Right front turn signal/auxiliary lamp	4-place Multilock	Inner fairing - right fairing support brace (outboard side)
[32]	Front fender tip lamp jumper harness (DOM)	2-place Multilock (black)	Inner fairing - below upper for bracket (left side)
[33]	Ignition Switch	3-place Packard	Bottom of ignition switch
[34]	Right front speaker	Spade terminals	Inner fairing (back of speaker)
[35]	Left front speaker	Spade terminals	Inner fairing (back of speaker)
[38]	Headlamp	Headlamp connector	Inner fairing (back of headlamp)
[39]	Speedometer	12-place Packard	Inner fairing (back of speedometer)
[41]	Rear right speaker/passenger controls**	6-place Deutsch	Inside rear right speaker box
[42]	Rear left speaker/passenger controls**	6-place Deutsch	Inside rear left speaker box
[45]	Rear fender tip lamp (DOM)	3-place Multilock	Circuit board under tail lamp assembly
[47]	Stator	3-place Lyall	Bottom of voltage regulator (left side)
[50]	CB antenna cable**	-	Inner fairing - back of CB module
[51]	Radio antenna cable**	-	Inner fairing - back of radio (left side)
[53]	Console pod**	12-place Deutsch	Rear of battery box (under seat)
[64]	Fuse block/relays	Packard	Under left side cover
[65]	VSS	3-place Delphi	Top of transmission case (under starter)
[76]	Passenger headset	7-place DIN	Below rear left speaker box
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)
[78]	ECM	73-place Delphi	Under seat

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Table B-1. FLHX, FLHT/C/U Connector Locations

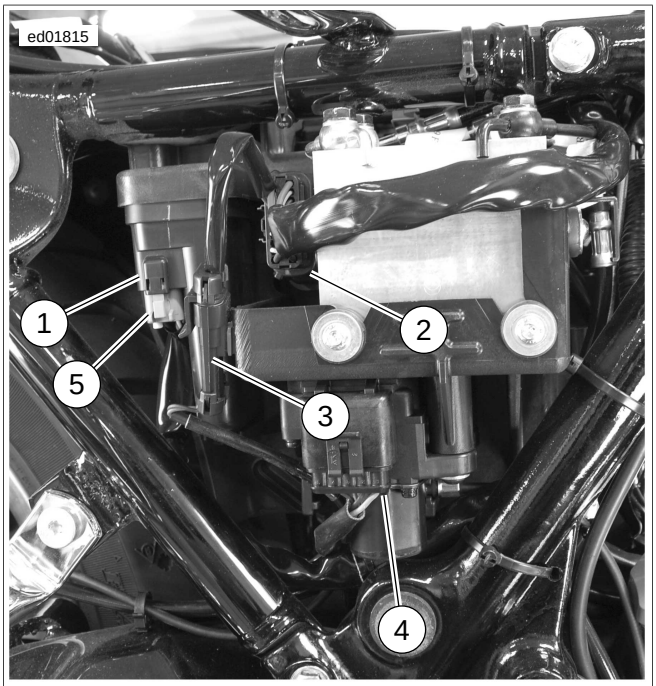
NO.	DESCRIPTION	TYPE	LOCATION
[79]	CKP sensor	2-place Deutsch	Rear of lower front frame crossmember
[80]	TMAP sensor	4-place Bosch	Top of induction module
[83]	Ignition coil	4-place Delphi	Bottom front of battery tray
[84]	Front injector	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	4-place Deutsch	Under left side cover
[93]	Tail lamp	4-place Multilock	Circuit board under tail lamp assembly
[94]	Rear fender lights harness in circuit board	6-place Multilock	Circuit board under tail lamp assembly
[95]	Purge solenoid	2-place Delphi	Under seat
[105]	Fairing cap switches	12-place Multilock	Inner fairing - above upper fork bracket (right side)
[107]	Ambient Air Temperature (AAT) sensor*	3-place Multilock	Steering head, left side
[108]	Tachometer	12-place Packard	Inner fairing (back of tachometer)
[111]	Voltmeter lamp	Spade terminals	Inner fairing (back of voltmeter)
[112]	Oil pressure gauge lamp	Spade terminals	Inner fairing (back of oil pressure gauge)
[113]	Oil pressure gauge	Spade terminals	Inner fairing (back of oil pressure gauge)
[114]	Air temperature gauge lamp	Spade terminals	Inner fairing (back of air temperature gauge)
[115]	Air temperature gauge	Spade terminals	Inner fairing (back of air temperature gauge)
[116]	Fuel gauge lamp	Spade terminals	Inner fairing (back of fuel gauge)
[117]	Fuel gauge	Spade terminals	Inner fairing (back of fuel gauge)
[120]	Oil pressure switch	2-place Delphi	Front right crankcase
[121]	Rear stop lamp switch	Spade terminals	Bottom of rear frame downtube (right side)
[122]	Horn	Spade terminals	Between cylinders (left side)
[128]	Starter solenoid	Spade terminals	Top of starter
[GND1] [GND1A] [GND2]	Harness grounds	Ring terminals	Under seat
[131]	Neutral switch	Post terminals	Top of transmission (right side)
[132]	Cigarette lighter*	Spade terminals	Inner fairing
[133]	Jiffy stand sensor	3-place Molex (black)	Domestic (not used): Rear of lower front frame crossmember.
			HDI: Rear of lower front frame cross-member.
[134]	BAS	3-place Packard	Under right side cover
[137]	O2 sensor rear exhaust header	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	2-place Amp (Tyco)	Back of cross brace between front frame downtubes
[141]	Fuel pump and fuel level sender	4-place Packard	Under console on top of fuel tank canopy

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Table B-1. FLHX, FLHT/C/U Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[142]	Security siren (optional)	3-place Delphi	Under left side cover
[143]	Front fender tip lamp (DOM)	2-place Multilock	Under front fender tip lamp bracket
[160]	B+	1-place Delphi	Under seat
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Packard	Inner fairing - below upper fork bracket (left side)
[168]	Rear wheel speed sensor	2-place Packard	Under right side cover
[179]	Active exhaust actuator	5-place Amp (Tyco)	Domestic (not used)
			HDI: Under right side cover
[184]	CB module	12-place Deutsch	Inner fairing - left side of radio
[185]	XM connector	1-place	Inner fairing - back of radio
[201]	ABS diode	4-place Deutsch	Under left side cover (below fuse box)
[204]	TGS harness	6-place Molex (black)	Inner fairing - right fairing support bracket
[208]	HFSM antenna jumper harness	4-place Deutsch	Under right side cover
[209]	HFSM antenna	2-place Molex	Under seat
[211]	TCA	6-place Molex	Right side of engine (induction module)
[224]	TGS	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)
*Classic and Ultra **Ultra Only			

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. TSM/TSSM/HFSM [30]
2. ABS Control Module [166]
3. Rear Wheel Speed Sensor [168]
4. Active exhaust actuator [179]
5. HFSM antenna jumper harness [208]

Figure B-2. ABS Connector

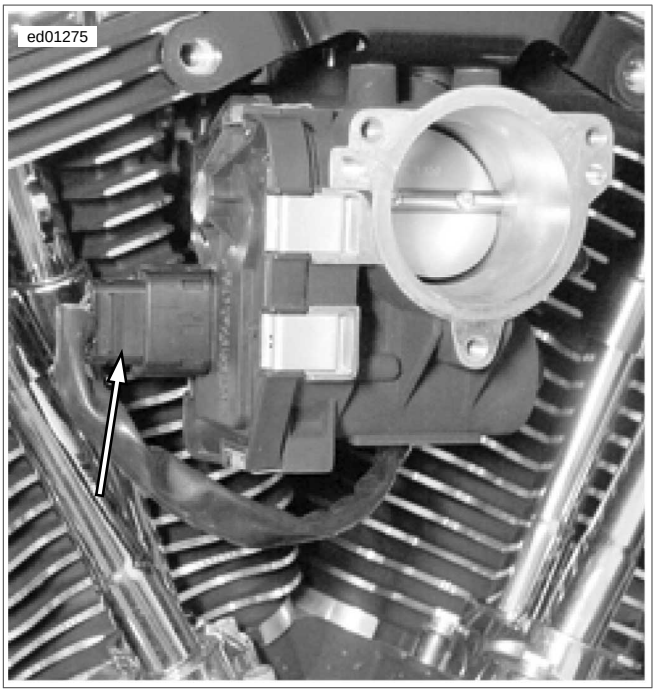


Figure B-3. Throttle Control Connector

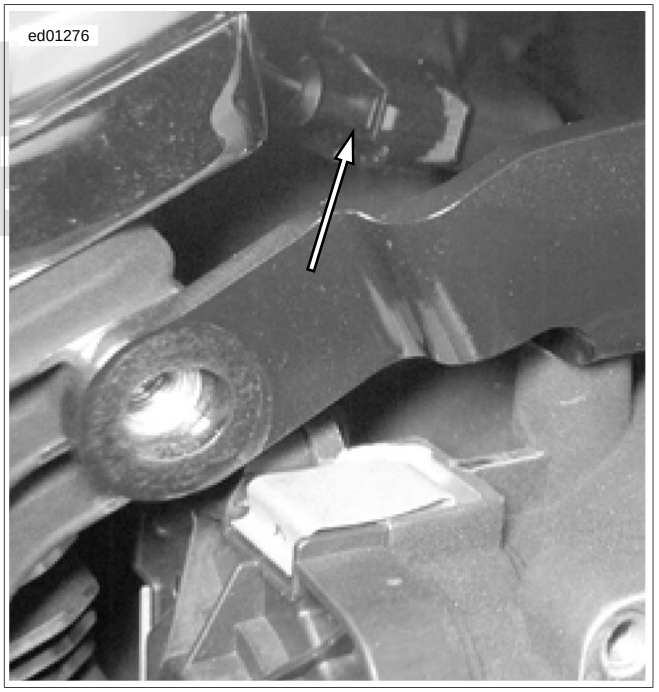
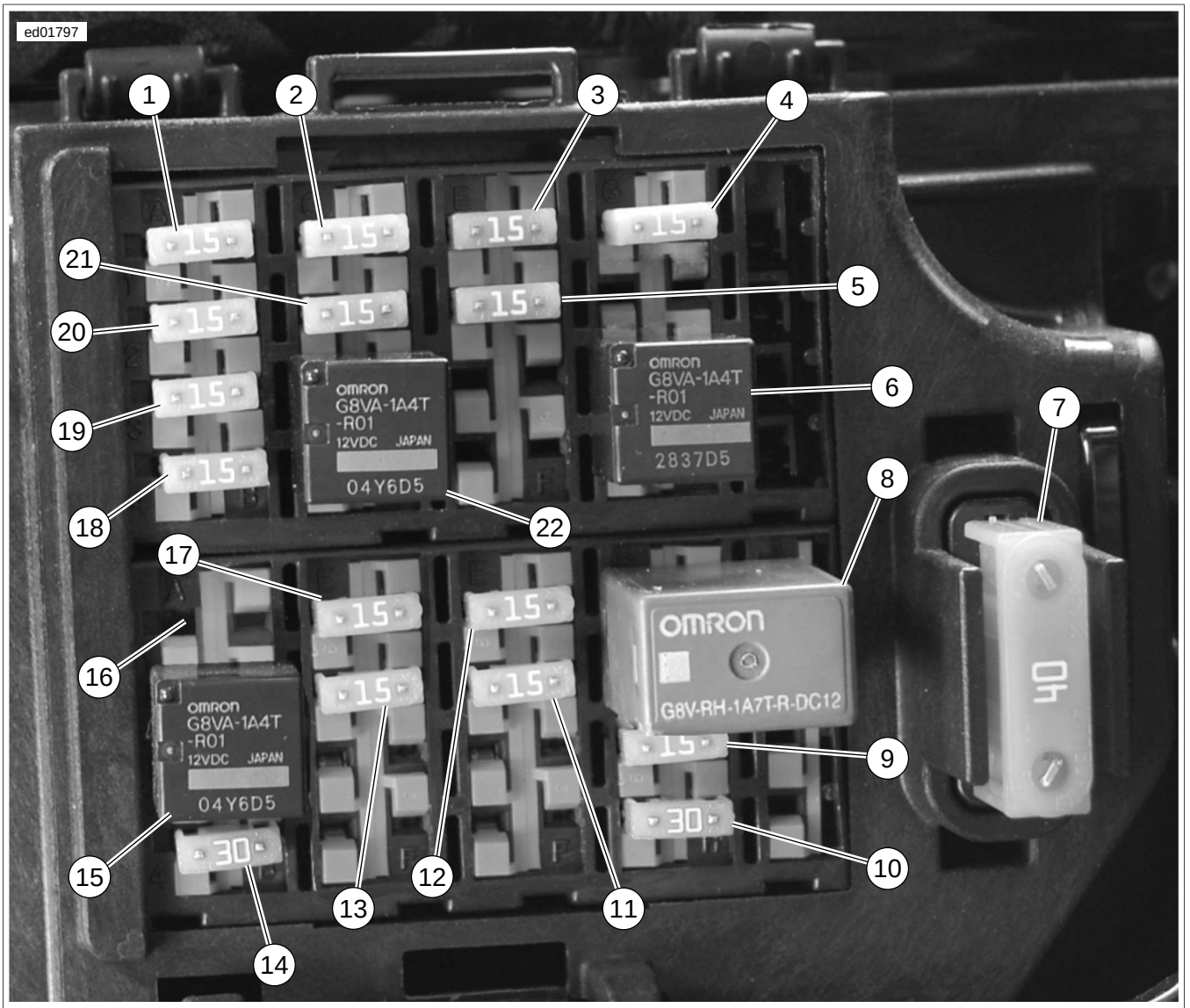
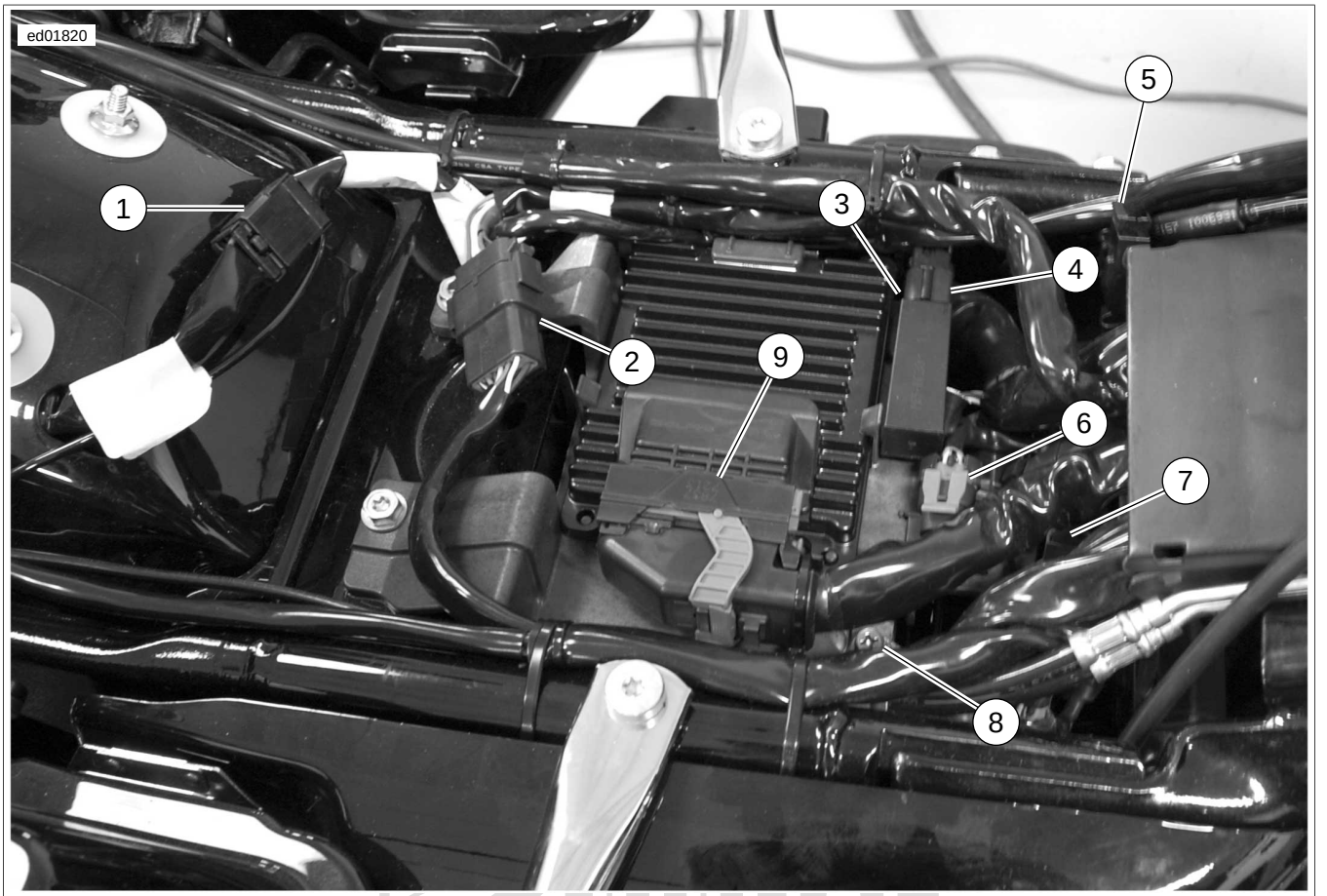


Figure B-4. TMAP Connector



1. Brake/cruise
2. Accessory
3. P&A
4. Radio power/Siren
5. ECM power
6. Start relay
7. MAXIFUSE
8. Lighting relay
9. Spare
10. Spare
11. Lights
12. Ignition
13. Headlamp
14. ABS
15. Brake relay
16. P&A IGN (2A Max)
17. Instruments
18. Fuel pump
19. Exhaust control
20. Radio memory
21. Battery
22. System relay

Figure B-5. Fuse and Relay Locations



1. Tail Light Connector [7]
2. Console pod [53]
3. Positive Battery Terminal
4. Hands-Free Antenna Connector [209]
5. Fuel Pump Subharness Connector [13]
6. Purge solenoid [95]
7. P&A Accessory Connector [4]
8. Negative Battery Terminal
9. ECM [78]

Figure B-6. Electrical Connectors - Under Seat

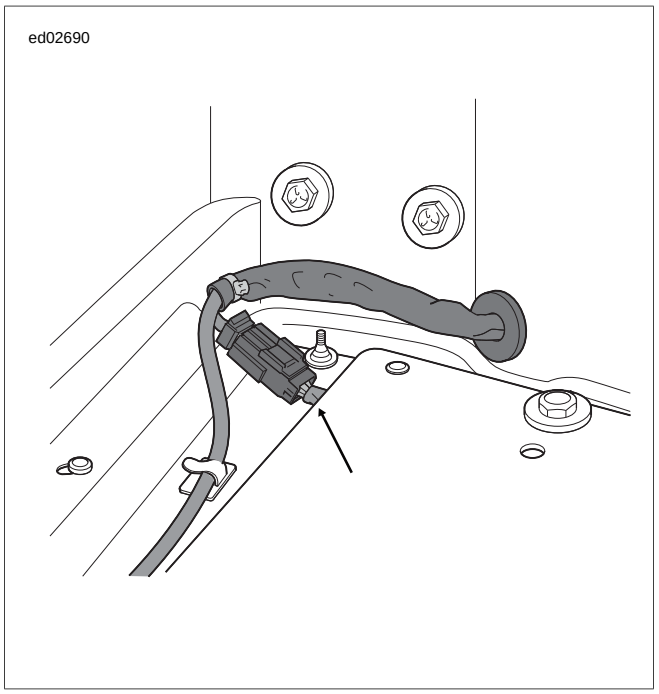
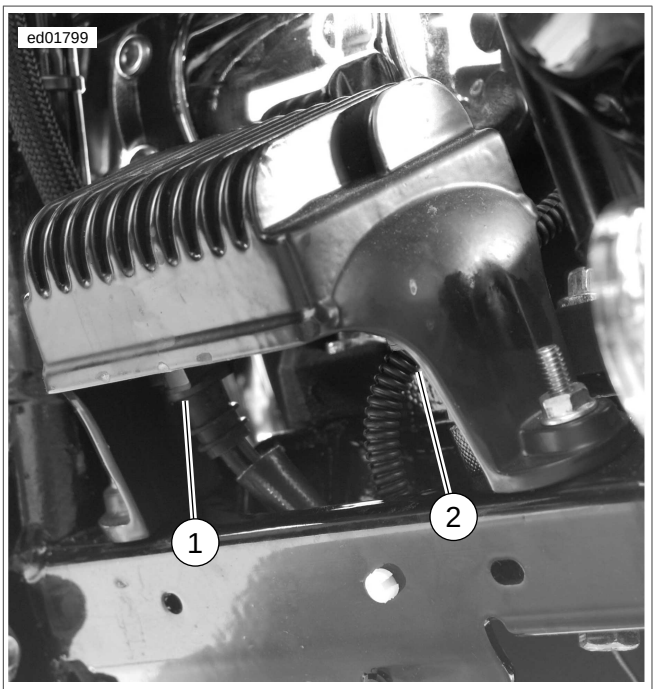


Figure B-7. Tour-Pak Connectors (Left Side)



1. Voltage regulator [77]
2. Stator [47]

Figure B-9. Voltage Regulator (Left Side View)

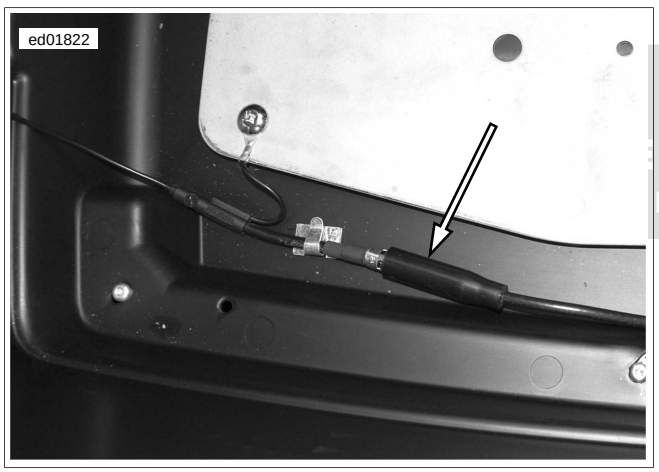


Figure B-8. Tour-Pak Connectors (Right Side)

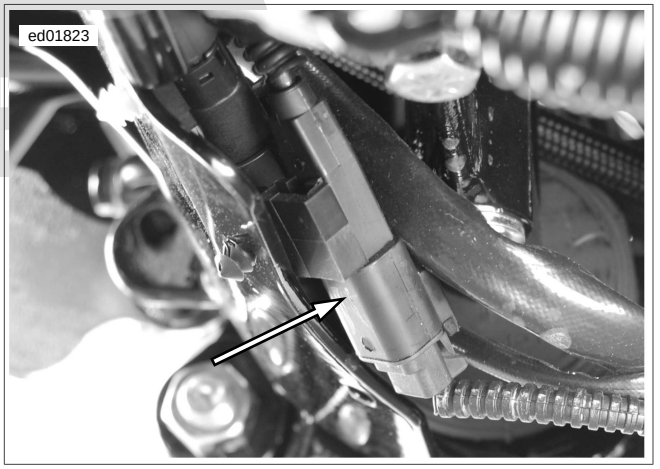
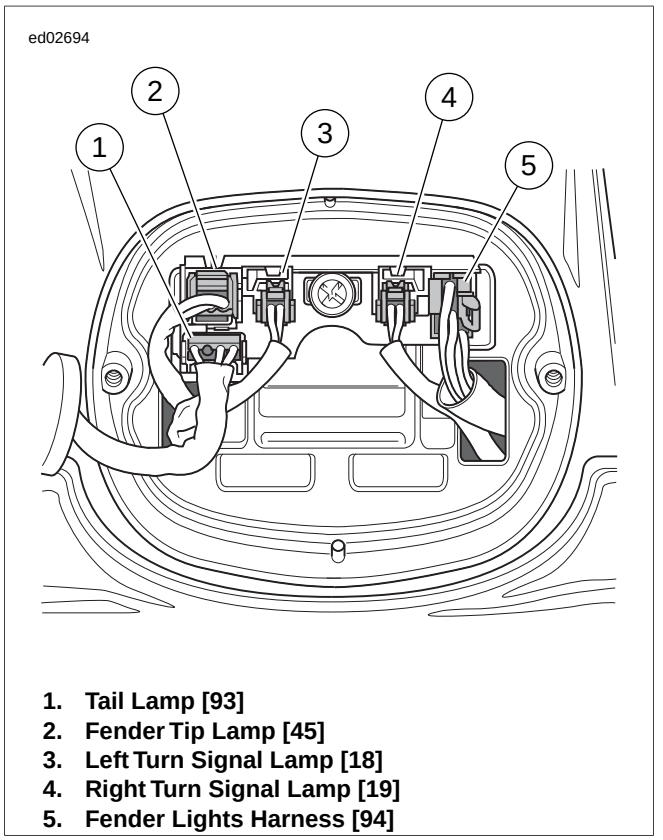


Figure B-10. CKP Sensor [79] (from underneath)

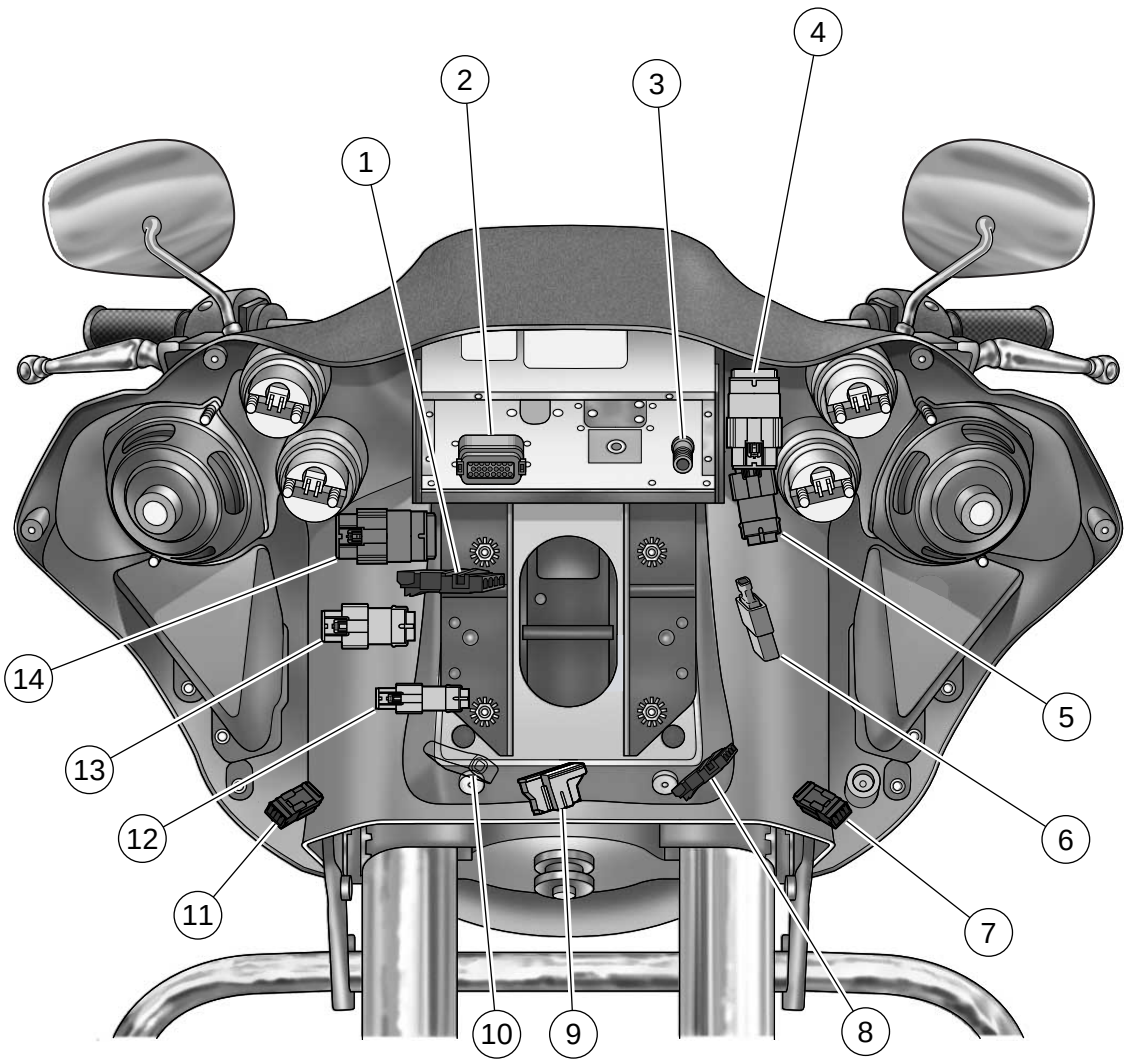


1. **Tail Lamp [93]**
2. **Fender Tip Lamp [45]**
3. **Left Turn Signal Lamp [18]**
4. **Right Turn Signal Lamp [19]**
5. **Fender Lights Harness [94]**

Figure B-11. Rear Fender Lights Assembly

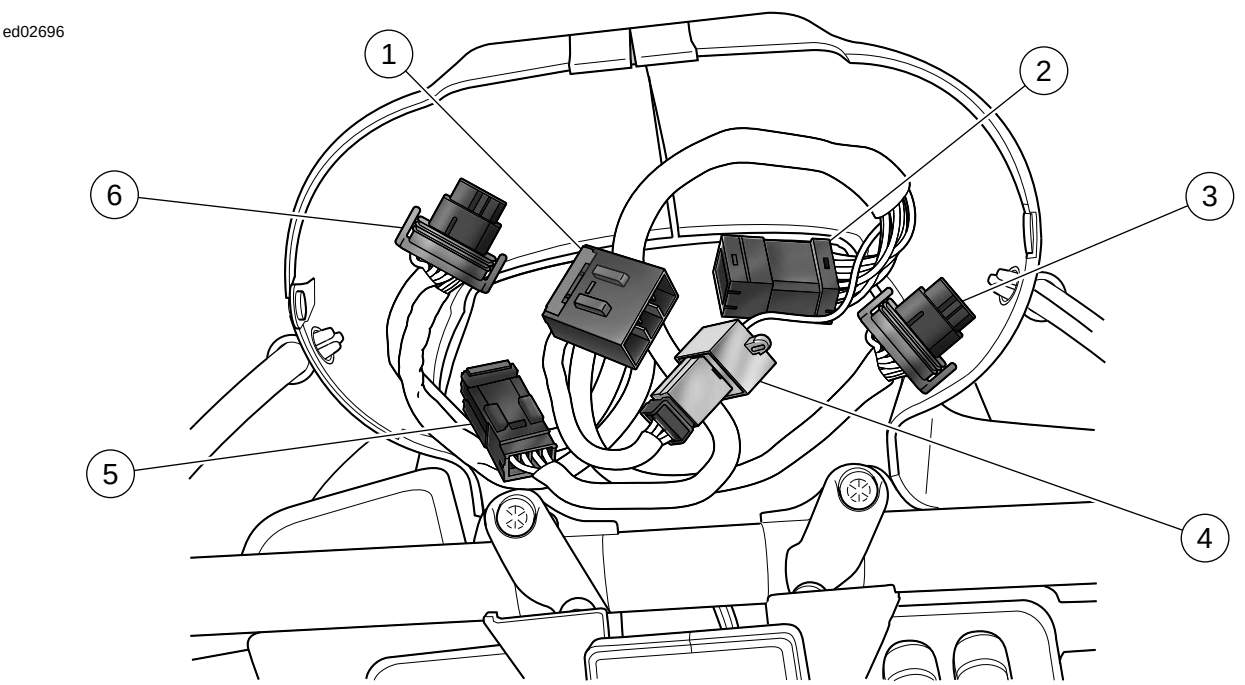
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1. Main to interconnect harness [15]
2. Radio [27]
3. Radio antenna cable [51]
4. Interconnect to left handlebar switches [24]
5. Interconnect to right handlebar switches [22]
6. Audio to interconnect harness [6]
7. Left front turn signal/auxiliary lamp [31L]
8. Front wheel speed sensor [167]
9. Headlamp [38]
10. HDI position lamp [29]
11. Right front turn signal/auxiliary lamp [31R]
12. TGS harness [204]
13. Main to interconnect harness [2]
14. Main to interconnect harness [1]

Figure B-12. Inner Fairing Connectors (FLTR)



1. **Indicator Lamps [21]**
2. **Instrument Nacelle Switches [105A/B]**
3. **Tachometer [108]**
4. **Ambient Temperature Sensor [107]**
5. **Speaker Switch [105C/D]**
6. **Speedometer [39]**

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Figure B-13. Instrument Nacelle Connectors (FLTR)

Table B-2. FLTR Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to interconnect harness	16-place Molex (black)	Inner fairing - right side below radio
[2]	Main to interconnect harness	12-place Molex (gray)	Inner fairing - left radio support bracket
[4]	Accessory	4-place Deutsch	Upper frame crossmember (under seat)
[5]	MAXIFUSE	2-place Packard	Under left side cover
[6]	Audio connector	6-place Deutsch	Inner fairing - right fairing support brace
[7]	Rear fender lights harness	8-place Multilock	Top of rear fender (under seat)
[13]	Fuel tank harness	4-place Multilock	Behind fuel tank (under seat)
[15]	Main to interconnect harness	4-place Delphi	Inner fairing - below radio (right side)
[18]	Left rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[19]	Right rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[21]	Indicator lamps	10-place Multilock	Inner fairing - above radio
[22]	Interconnect to right handlebar switches	12-place Molex (black)	Inner fairing - right fairing support bracket
[24]	Interconnect to left handlebar switches	16-place Molex (gray)	Inner fairing - left fairing support brace
[27]	Radio	23-place Amp (Tyco)	Inner fairing - back of radio (right side)

Table B-2. FLTR Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[29]	HDI position lamp	Spade terminals	Back of headlamp
[30]	TSM/HFSM	12-place Deutsch	Under right side cover
[31L]	Left front turn signal	4-place Multilock	Inner fairing - left (outboard side)
[31R]	Right front turn signal	4-place Multilock	Inner fairing - right (outboard side)
[33]	Ignition switch	3-place Packard	Bottom of ignition switch
[34]	Right front speaker	Spade terminals	Inner fairing (back of speaker)
[35]	Left front speaker	Spade terminals	Inner fairing (back of speaker)
[38]	Headlamp	Headlamp connector	Inner fairing (back of headlamp)
[39]	Speedometer	12-place Packard	Instrument nacelle (back of speedo-meter)
[45]	Rear fender tip lamp (DOM)	3-place Multilock	Circuit board under tail lamp assembly
[47]	Stator	3-place Lyall	Bottom of voltage regulator (left side)
[51]	Radio antenna cable	-	Inner fairing - back of radio (left side)
[64]	Fuse block/relays	Packard	Under left side cover
[65]	VSS	3-place Delphi	Top of transmission case (under starter)
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)
[78]	ECM	73-place Delphi	Under seat
[79]	CKP sensor	2-place Deutsch	Rear of lower front frame crossmember
[80]	TMAP sensor	4-place Bosch	Top of induction module
[83]	Ignition coil	4-place Delphi	Lower front of battery tray
[84]	Front injector	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	4-place Deutsch	Under left side cover
[93]	Tail lamp	4-place Multilock	Circuit board under tail lamp assembly
[94]	Rear fender lights harness in circuit board	6-place Multilock	Circuit board under tail lamp assembly
[95]	Purge solenoid	2-place Delphi	Under seat
[105]	Instrument nacelle switches		
	Interconnect to nacelle switch harness (105A, 105B)	12-place Multilock	Inside instrument nacelle (under bezel)
	Nacelle switch harness to speaker switch (105C, 105D)	4-place Multilock	Inside instrument nacelle (under bezel)
[107]	Ambient Air Temperature (AAT) sensor	3-place Multilock	Inside instrument nacelle (under bezel)
[108]	Tachometer	12-place Packard (gray)	Instrument nacelle (back of tacho-meter)
[111]	Voltmeter lamp	Spade terminals	Inner fairing (back of voltmeter)
[112]	Oil pressure gauge lamp	Spade terminals	Inner fairing (back of oil pressure gauge)
[113]	Oil pressure gauge	Spade terminals	Inner fairing (back of oil pressure gauge)
[114]	Air temperature gauge lamp	Spade terminals	Inner fairing (back of air temperature gauge)
[115]	Air temperature gauge	Spade terminals	Inner fairing (back of air temperature gauge)

Table B-2. FLTR Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[116]	Fuel gauge lamp	Spade terminals	Inner fairing (back of fuel gauge)
[117]	Fuel gauge	Spade terminals	Inner fairing (back of fuel gauge)
[121]	Rear brake light switch	Spade terminals	Mid-chassis, lower right side (between frame and exhaust pipe)
[122]	Horn	Spade terminals	Between cylinders (right side)
[128]	Starter solenoid	Spade terminals	Top of starter
[129]	Harness grounds	Ring terminals	Upper frame crossmember (under seat)
[131]	Neutral switch	Post terminals	Top of transmission (right side)
[132]	Cigarette lighter	Spade terminals	Inner fairing
[133]	Jiffy stand sensor	3-place Molex (black)	Domestic (not used): Rear of lower front frame crossmember.
			HDI: Rear of lower front frame cross-member.
[134]	Sidecar Bank Angle Sensor (BAS)	3-place Packard	Under seat
[135]	EFI system relay	Relay	Fuse block (under right side cover)
[137]	O2 sensor rear exhaust header	2-place Amp (Tyco)	Under chrome starter cover
[138]	O2 sensor front exhaust header	2-place Amp (Tyco)	Back of cross brace between front frame downtubes (left side)
[139]	Oil pressure switch	2-place Delphi	Front right crankcase
[141]	Fuel pump and fuel level sender	4-place Packard	Top of canopy (under console)
[142]	Security siren (optional)	3-place Delphi	Under left side cover
[160]	B+	1-place Delphi	Under seat
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Delphi (black)	Inner fairing - below upper fork bracket (left side)
[168]	Rear wheel speed sensor	2-place Delphi (black)	Under right side cover
[179]	Active exhaust actuator	5-place Amp (Tyco)	Domestic (not used)
			HDI: Under right side cover
[201]	ABS diode	4-place Deutsch	Under left side cover (below fuse box)
[204]	TGS harness	6-place Molex (black)	Inner fairing - right side below radio
[208]	HFSM antenna jumper harness	4-place Deutsch	Right side cover
[209]	HFSM antenna	2-place Molex	Under seat
[211]	TCA	6-place Molex	Right side of engine (induction module)
[224]	TGS	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)

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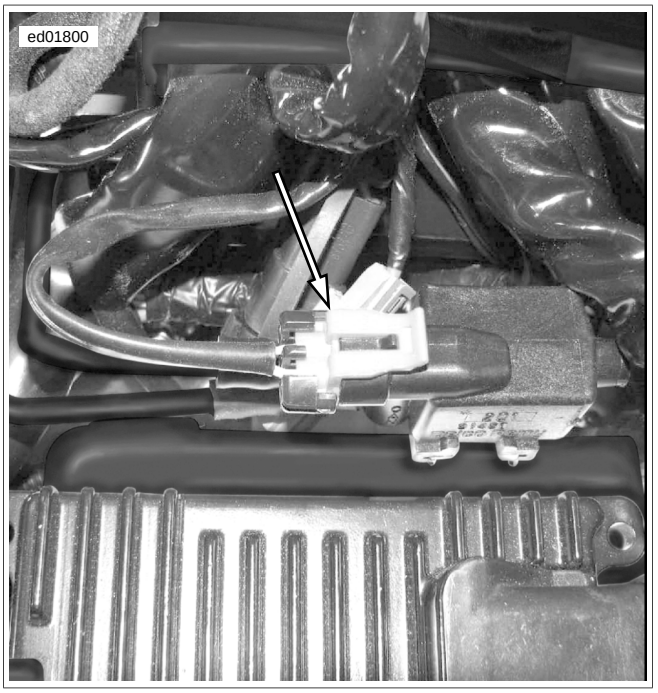


Figure B-14. [95] Purge Solenoid (Under seat)

Table B-3. FLHR/C/S Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[4]	Accessory	4-place Deutsch	Upper frame crossmember (under seat)
[5]	MAXIFUSE	2-place Packard	Under left side cover
[7]	Rear fender lights harness	6-place Multilock	Top of rear fender (under seat)
[18]	Left rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[19]	Right rear turn signal	2-place Multilock	Circuit board under tail lamp assembly
[20]	Console harness	16-place Molex	Under seat
[21]	Indicator lamps	8-place Deutsch	Under console
[22]	Right handlebar switches	6-place Molex (black)	Inside headlamp nacelle - fork stem nut lock plate (right side)
[24]	Left handlebar switches	8-place Molex (gray)	Inside headlamp nacelle - fork stem nut lock plate (left side)
[30]	TSM//HFSM	12-place Deutsch	Under right side cover
[31]	Front turn signals	6-place Multilock	Inside headlamp nacelle - fork stem nut lock plate (left side)
[32]	Front fender tip lamp jumper harness (DOM)	2-place Multilock	Inside headlamp nacelle
[33]	Ignition switch	3-place Packard	Under console
[38]	Headlamp	Headlamp connector	Inside headlamp nacelle
[39]	Speedometer	12-place Packard	Back of speedometer (back of console)
[45]	Rear fender tip lamp (DOM)	3-place Multilock	Circuit board under tail lamp assembly
[47]	Stator	3-place Lyall	Bottom of voltage regulator (left side)
[64]	Fuse block/relays	Packard	Under left side cover
[65]	VSS	3-place Delphi	Top of transmission case (under starter)
[67]	Accessory switch	4-place Amp (Tyco)	Inside headlamp nacelle
[73]	Auxiliary lamps	2-place Multilock (white)	Inside headlamp nacelle
[77]	Voltage regulator	2-place Lyall	Bottom of voltage regulator (right side)

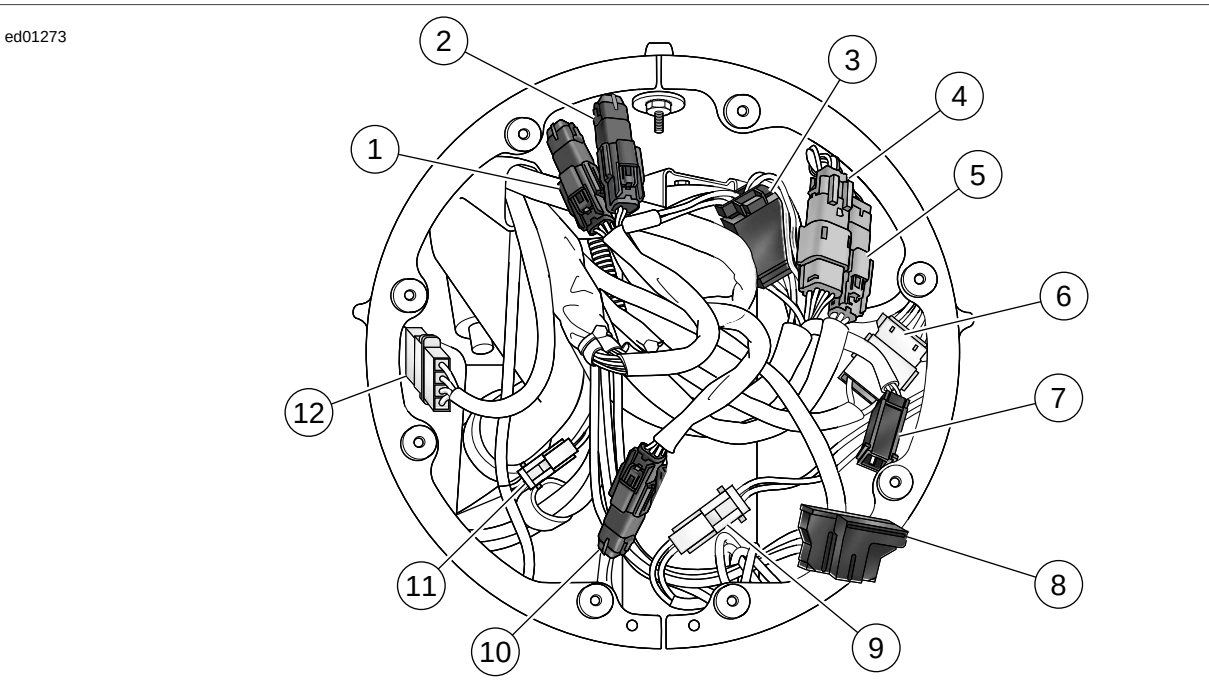
Table B-3. FLHR/C/S Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	73-place Delphi	Under seat
[79]	CKP sensor	2-place Deutsch	Rear of lower front frame crossmember
[80]	TMAP sensor	4-place Bosch	Top of induction module
[83]	Ignition coil	4-place Delphi	Lower front of battery tray
[84]	Front injector	2-place Delphi	Below fuel tank (left side)
[85]	Rear injector	2-place Delphi	Below fuel tank (left side)
[90]	ET sensor	2-place Delphi	Back of front cylinder (left side)
[91]	DLC	4-place Deutsch	Under left side cover
[93]	Tail lamp	4-place Multilock	Circuit board under tail lamp assembly
[94]	Rear fender lights harness in circuit board	6-place Multilock	Circuit board under tail lamp assembly
[95]	Purge solenoid	2-place Delphi	Under seat
[108]	Optional tachometer	1-place Amp (Tyco)	Inside headlamp nacelle
[109]	Auxiliary lamps switch	4-place Amp (Tyco)	Inside headlamp nacelle
[117]	Fuel gauge	Spade terminals	Below fuel tank on left side
[121]	Rear brake light switch	Spade terminals	Mid-chassis, lower right side (between frame and exhaust pipe)
[122]	Horn	Spade terminals	Between cylinders (left side)
[128]	Starter solenoid	Spade terminals	Top of starter
[129]	Harness grounds	Ring terminals	Upper frame crossmember (under seat)
[131]	Neutral switch	Post terminals	Top of transmission (right side)
[133]	Jiffy stand sensor	3-place Molex (black)	Domestic: Rear of lower front frame crossmember.
			HDI: Rear of lower front frame cross-member.
[134]	Sidecar Bank Angle Sensor (BAS)	3-place Packard	Under seat
[137]	O2 sensor rear exhaust header	2-place Amp (Tyco)	Under starter
[138]	O2 sensor front exhaust header	2-place Amp (Tyco)	Back of cross brace between front frame downtubes (left side)
[139]	Oil pressure switch	2-place Delphi	Front right crankcase
[141]	Fuel pump and fuel level sender	4-place Packard	Top of canopy (under console)
[142]	Security siren (optional)	3-place Delphi	Under left side cover
[143]	Front fender tip lamp (DOM)	2-place Multilock (black)	Under front fender tip lamp bracket
[158]	Left handlebar switches (cruise control)**	3-place Molex (black)	Inside headlamp nacelle
[159]	Right handlebar switches (cruise control)**	3-place Molex (gray)	Inside headlamp nacelle
[160]	B+	1-place Packard	Under seat
[166]	ABS module	20-place Molex	Under right side cover
[167]	Front wheel speed sensor	2-place Delphi (black)	Inner fairing - below upper fork bracket (left side)
[168]	Rear wheel speed sensor	2-place Delphi (black)	Under right side cover
[179]	Active exhaust actuator	5-place Amp (Tyco)	Domestic (not used)
			HDI: Under right side cover
[201]	ABS diode	4-place Deutsch	Under left side cover (below fuse box)

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Table B-3. FLHR/C/S Connector Locations

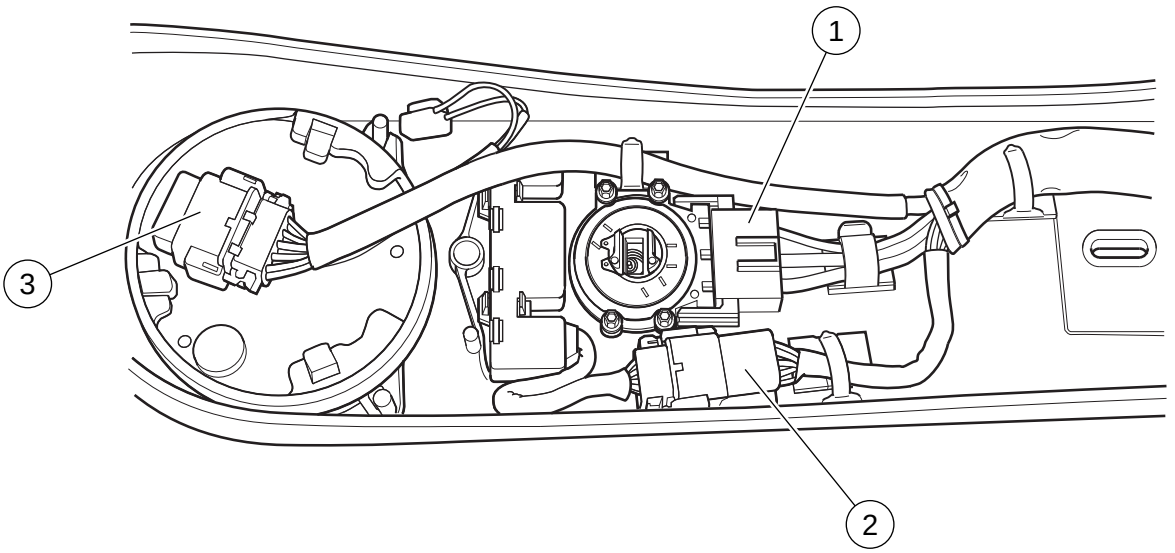
NO.	DESCRIPTION	TYPE	LOCATION
[204]	TGS harness	6-place Molex (black)	Inside headlamp nacelle - fork stem nut lock plate
[208]	HFSM antenna jumper harness	4-place Deutsch	Left side cover
[209]	HFSM antenna	2-place Molex	Under seat
[211]	TCA	6-place Molex	Throttle body
[222]	Console ignition switch interconnect	4-place Packard	Under seat
[224]	TGS	7-place Amp (Tyco)	Handlebar throttle (inside right side handlebar)
** FLHRC Only			



1. **[22] Right Handlebar Switches**
2. **[24] Left Handlebar Switches**
3. **[31] Front Turn Signals**
4. **[32] Front Fender Tip Lamp (Used on FLHR Only)**
5. **[38] Headlamp**
6. **[67] Accessory Switch**
7. **[73] Auxiliary Lamps**
8. **[109] Auxiliary Lamps Switch**
9. **[158] Cruise On/Off Switch (Used on FLHR/C Only)**
10. **[159] Cruise Set/Resume Switch (Used on FLHR/C Only)**

Figure B-15. Headlamp Nacelle Connectors (FLHR/C)

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1. **Ignition/Light Key Switch [33]**
2. **Indicator Lights [21]**
3. **Speedometer [39]**

Figure B-16. Instrument Console Connectors (FLHR/C)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

WIRING DIAGRAMS B.2

WIRING DIAGRAM INFORMATION

Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table B-4.

For Solid Color Wires: See Figure B-17. The alpha code identifies wire color (3).

For Striped Wires: The code is written with a slash (/) between the solid color code and the stripe code (4). For example, a trace labeled GN / Y is a green wire with a yellow stripe.

Wiring Diagram Symbols

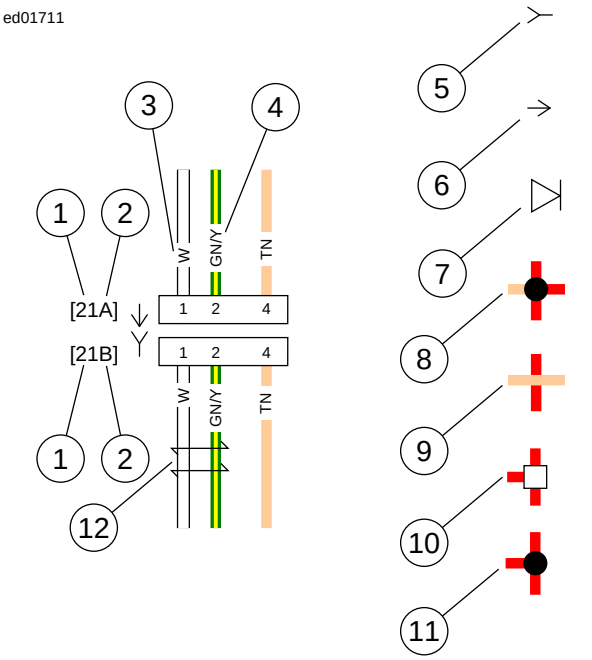
See Figure B-17. On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets (1). The letter (2) inside the brackets identifies whether the housing is a socket or pin housing.

A=Pin: The letter A after a connector number and the pin symbol (6) identifies a pin housing.

B=Socket: The letter B after a connector number and the socket symbol (5) identifies a socket housing.

Other symbols found on the wiring diagrams include the symbol for a diode (7), a symbol for a wire-to-wire connection (8), a symbol verifying that no connection (9) between two wire traces exists, symbols for actual (10) and virtual (11) splices, and a symbol identifying two wires that are twisted together (12).

Actual splices (10) are splices where two wires are connected together at a specific location along a wire. Virtual splices (11) are splices shown connected anywhere along a wire, usually used in a wiring or schematic diagram for clarity.



1. **Connector number**
2. **Terminal code (A=pin, B=socket)**
3. **Solid wire color**
4. **Striped wire color**
5. **Socket symbol**
6. **Pin symbol**
7. **Diode**
8. **Connection**
9. **No connection**
10. **Physical splice**
11. **Virtual splice**
12. **Twisted pair**

Figure B-17. Connector/Wiring Diagram Symbols (typical)

Table B-4. Wire Color Codes

ALPHA CODE	WIRE COLOR
BE	Blue
BK	Black
BN	Brown
GN	Green
GY	Grey
LGN	Light Green
O	Orange
PK	Pink
R	Red
TN	Tan
V	Violet
W	White
Y	Yellow

2009 TOURING WIRING DIAGRAMS

Wiring Diagram List

DIAGRAM	LOCATION
MAIN HARNESS (1 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-18
MAIN HARNESS (2 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-19
MAIN HARNESS (3 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-20
MAIN HARNESS (4 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-21
MAIN HARNESS (5 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-22
INTERCONNECT HARNESS: 2009 FLHT. FLHTX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-23
HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM ANTENNA: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC INTERNATIONAL MODELS	Figure B-24
STARTING AND CHARGING: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-25
STARTING AND CHARGING: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS	Figure B-26
TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, & TOUR-PAK LAMPS: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS	Figure B-27
HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMPS, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS, AND AUX LAMP/ACCESSORY SWITCHES: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS	Figure B-28
CONSOLE TO MAIN HARNESS INTERCONNECT, IGNITION SWITCH INTERCONNECT AND ALL DOMESTIC & INTERNATIONAL MODELS ABS HARNESS: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS	Figure B-29
2009 Composite Ultra Audio Circuit	Figure B-30
2009 Ultra Audio Interconnect Harness	Figure B-31
2009 Basic Radio Interconnect Circuit	Figure B-32
2009 Ultra Radio RF Interconnect Circuit	Figure B-33

DIGITAL TECHNICIAN II HARLEY-DAVIDSON®

et00143

TSM/TSSM/HFSM
Battery 1 BN/GY
Ignition 2 GY
Serial Data 3 LGN/V
Neutral Switch 4 TN
Left Turn Feed 5 V
Right Turn Feed 6 BN
Right Turn SW Input 7 W/BN
Left Turn SW Input 8 W/V
Start Relay Control 9 TN/GN
Clutch Lockout Switch 10 BK/R
Alarm Signal 11 LGN/BN
Ground 12 BK/GN
[30A] [30B]
(GY)
To Main Harness (5 of 5)
R/BE
GN/O
BK/GN
BE/BK
W/BE
R/GN
LGN/V
GY
Y/GN
BE/GY
W/BK
BK
LGN/R
To Interconnect Harness [1A] (BK)
16 BE/BK
15 R/GN
14 W/BE
13 LGN/V
11 W/V
10 W/BN
9 O/BE
8 BN
7 V
6 W/BK
5 O/W
4 O/R
3 GY
2 O/V
1 O
[1B]
To Interconnect Harness [2A] (GY)
12 BK/GN
11 BK/R
10 TN
9 GN/Y
8 BN/GN
7 O
6 Y/BK
5 Y/W
4 BN/GY
3 BE
2 BK/R
1 R/BE
[2B]
To Interconnect Harness [15A]
D BK
C BK/GN
B BE
A R/O
[15B]
Oil Pressure Sender [139A]
B BN/GN
A GN/Y
[139B]
Fuel Pump
Fuel Pump Assembly Intank
A B C D [141A]
A B C D [141B]
Y/W O/GY BK/GN BK
70369-06 Fuel Tank Harness
O/GY Y/W BK/GN BK
1 2 3 4 [13B]
1 2 3 4 [13A]
Optional Security Siren
Power Signal Ground
1 2 3 [142A]
1 2 3 [142B]
BN/GY LGN/BN BK/GN
Red Band
BK
Battery
Start Solenoid [128B]
GN
Main Power At Starter
[BATT]
40 Amp MAXIFUSE
A B [5B]
Voltage Regulator
1 2 [77B]
B+ Connector [160B]
Ignition Switch [33A]
1 2 3 [33B]
R/GY R R/BK
64-1B
Brake 15A
Accessory 15A
P & A 15A
Radio Power/ Siren 15A
O/V 1B 1A
O/W 1D 1C R/GY
O/R 1F 1E R/GY
O/BE 1H 1G
GN 4G 5 87
R/GY 3H 3 30
TN/GN 3G 2 85
BK/R 4H 1 86
Start Relay
Radio Memory 15A
R/O 2B 2A R
Battery 15A
BN/GY 2D 2C R
ECM Power 15A
BE/GY 2F 2E R
Exhaust Control 15A
LGN/R 3B 3A R/BK
Fuel Pump 15A
O/GY 4B 4A
Y/GN 4C 5 87
BE/GY 3D 3 30
GN/O 3C 2 85
W/BK 4D 1 86
System Relay
P & A 2A IGN (MAX)
INSTRS 15A
Ignition 15A
O 1D 1C R/BK
GY 1F 1E R/BK
Lighting Relay
87 5 2G
30 3 1J R
85 2 2J
86 1 1G BK
Headlamp 15A
BE 2D 2C
Lights 15A
BE 2F 2E
Spare 15A
3H 3G
O/V 3A 5 87
R/Y 2B 3 30
R/BE 2A 2 85
BK 3B 1 86
Brake Relay
64-2B
Left GND Stud (Dirty)
BK GND1A
BK GND1
Right GND Stud (Clean)
GND2
BK/GN
BK/GN
Horn
Y/BK BK
[122A] [122B]
TN BK
Neutral Switch [131]
R/BE O/W
Rear Stop Light Switch [121]
[4A] 1 2 3 4
O/R R/Y O BK
Accessory Connector
[12B] (BK)
3 2 1
BK R/Y BE
Tour-Pak [12A]
1 2 3 5 6 7
BN O/W V BK R/Y BE
To Rear Lighting
[7A]

Figure B-18. MAIN HARNESS (1 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-18.
MAIN HARNESS (1 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

Figure B-18.
MAIN HARNESS (1 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

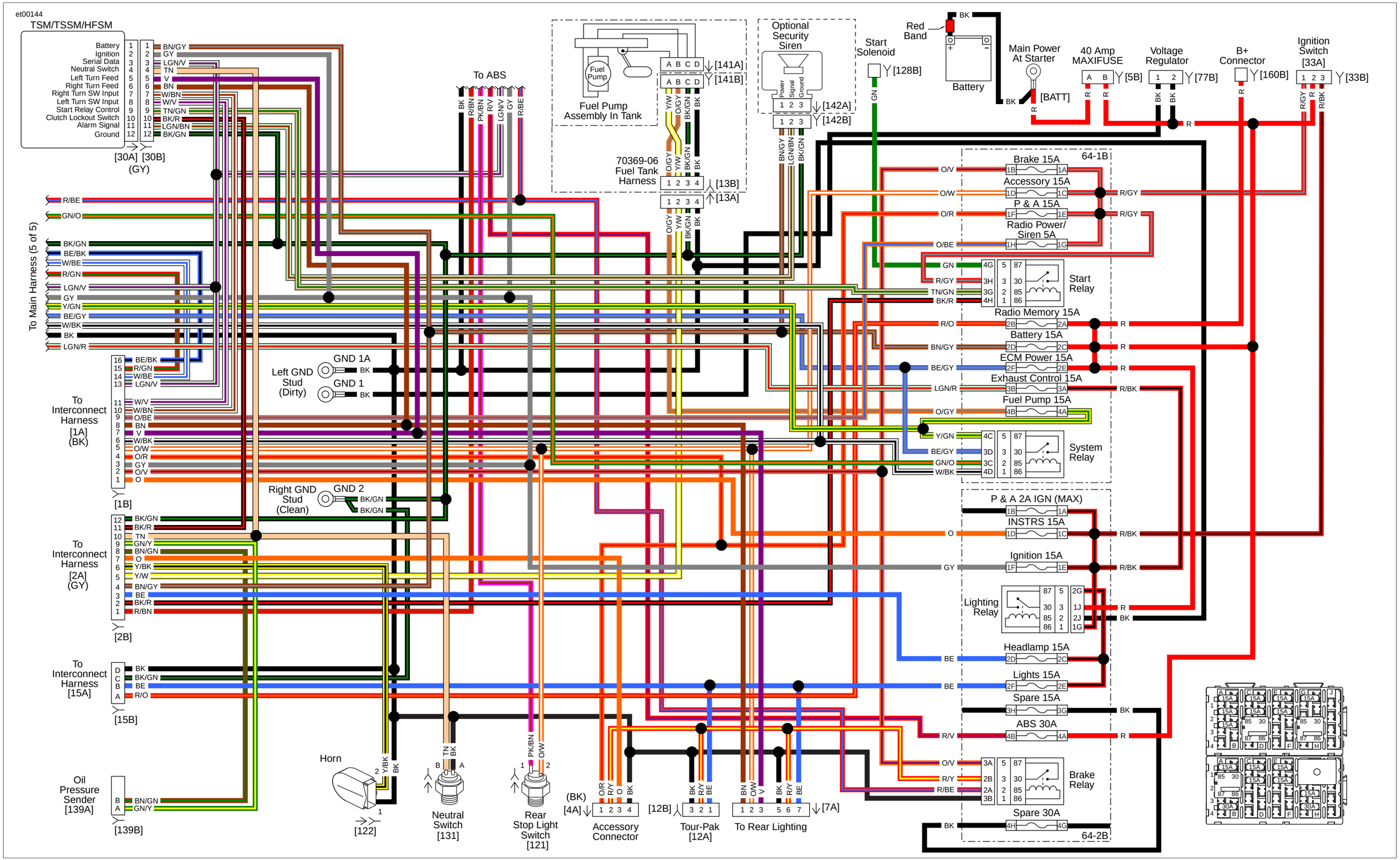


Figure B-19. MAIN HARNESS (2 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-19.
MAIN HARNESS (2 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

Figure B-19.
MAIN HARNESS (2 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

et00145

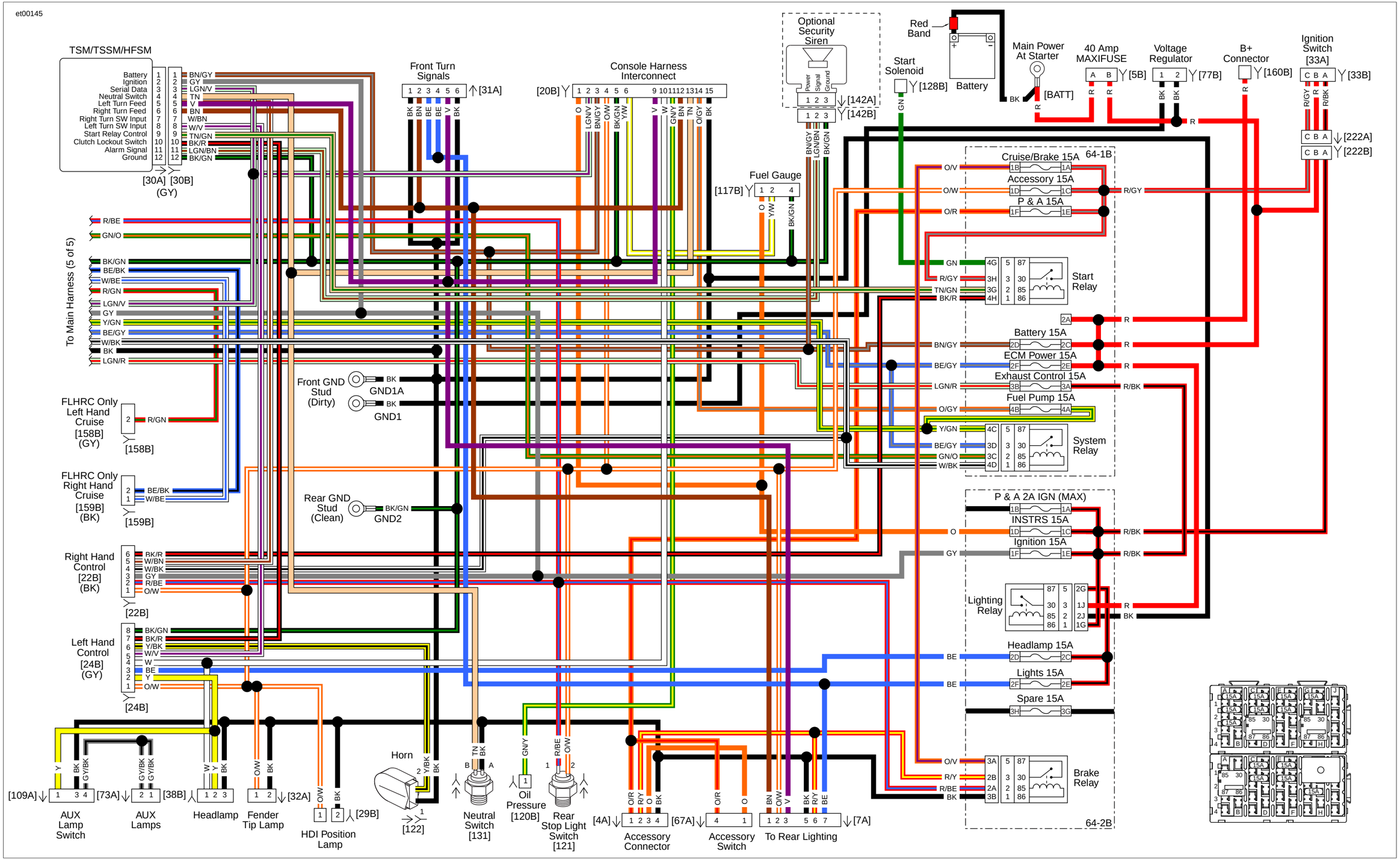


Figure B-20. MAIN HARNESS (3 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-20.
MAIN HARNESS (3 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

Figure B-20.
MAIN HARNESS (3 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

et00146

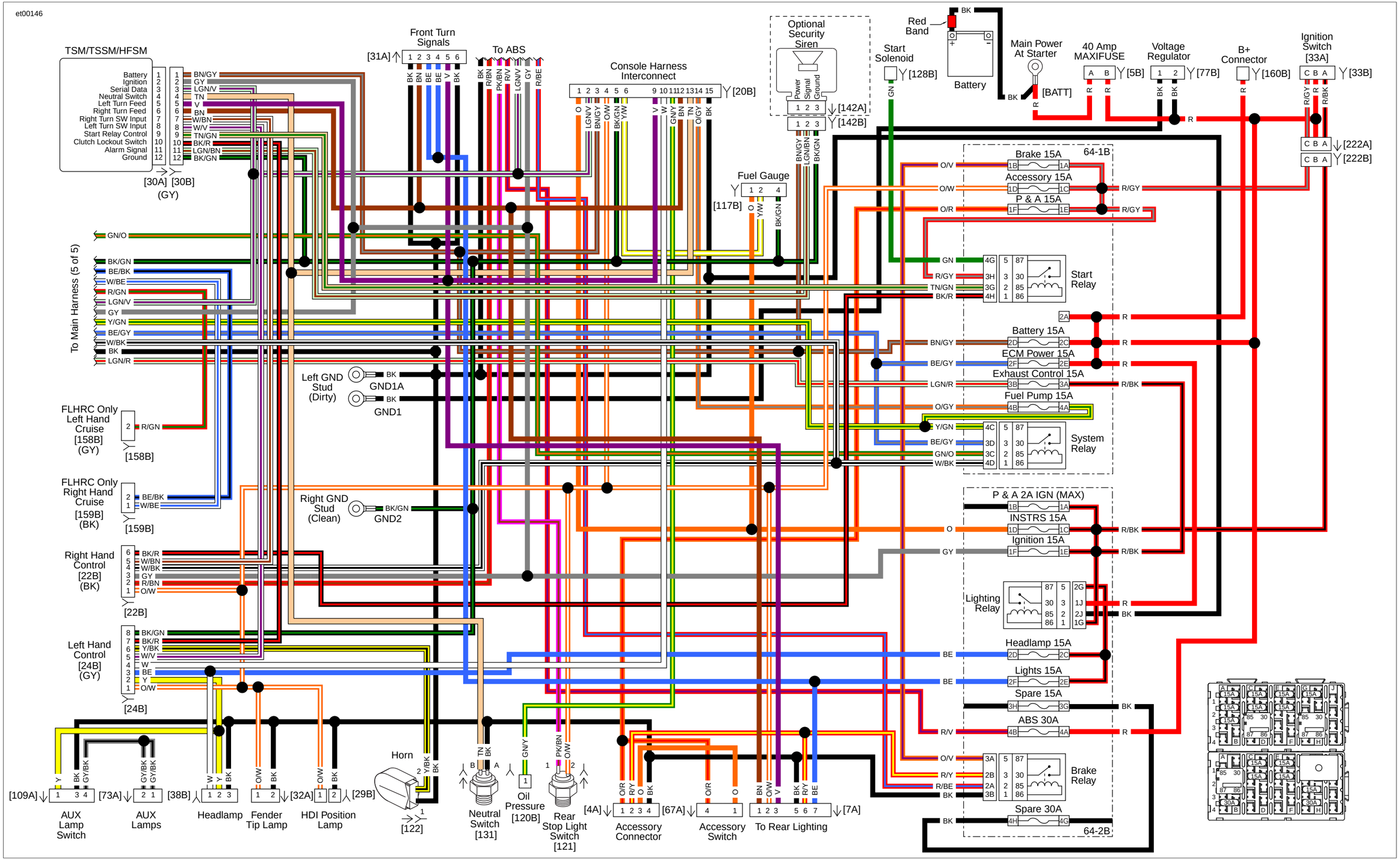


Figure B-21. MAIN HARNESS (4 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-21.
MAIN HARNESS (4 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

Figure B-21.
MAIN HARNESS (4 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

et00147

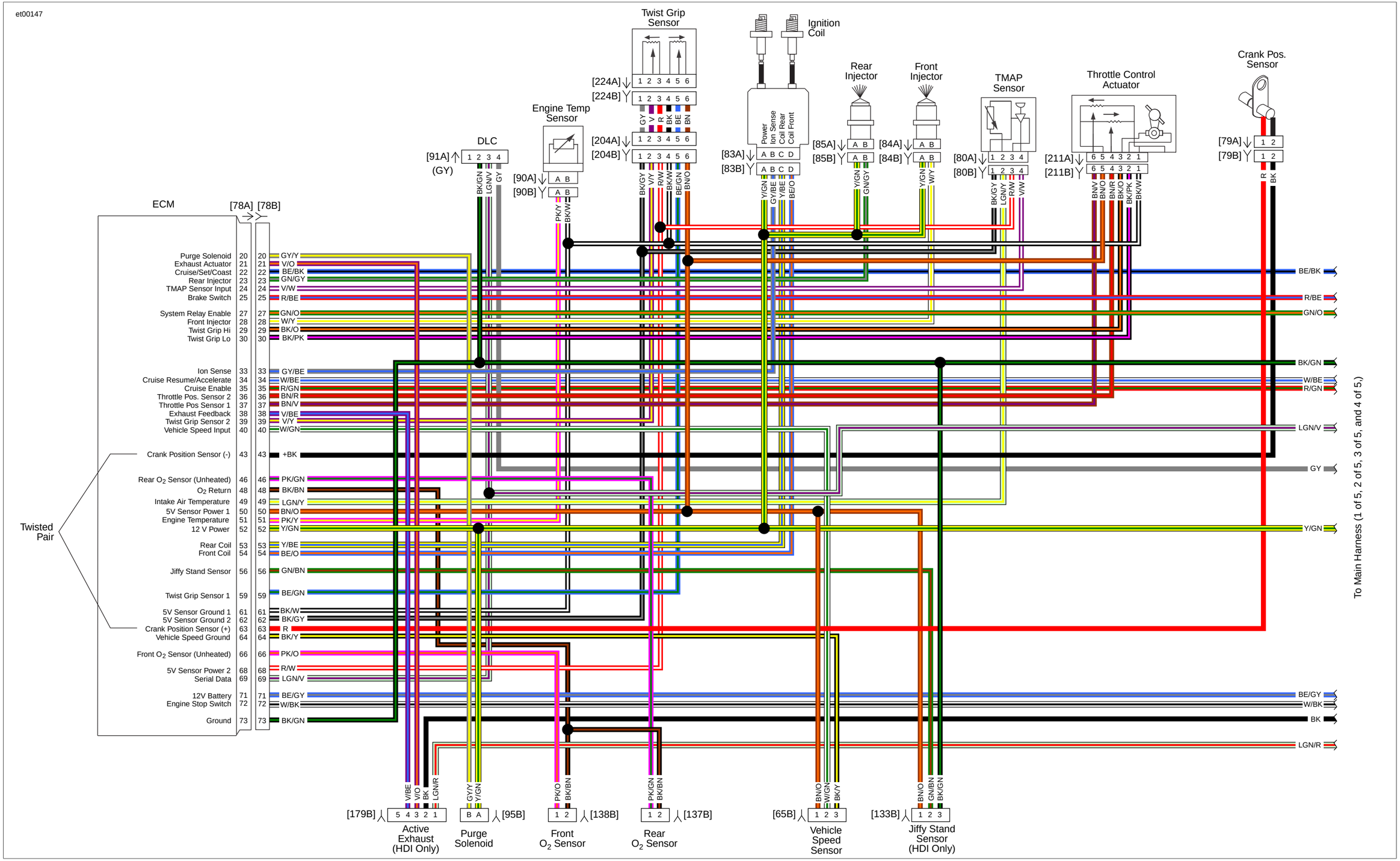


Figure B-22. MAIN HARNESS (5 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-22.
MAIN HARNESS (5 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

Figure B-22.
MAIN HARNESS (5 OF 5): 2009 FLHT, FLHX, FLHTC, & FLTR
DOMESTIC & INTERNATIONAL MODELS

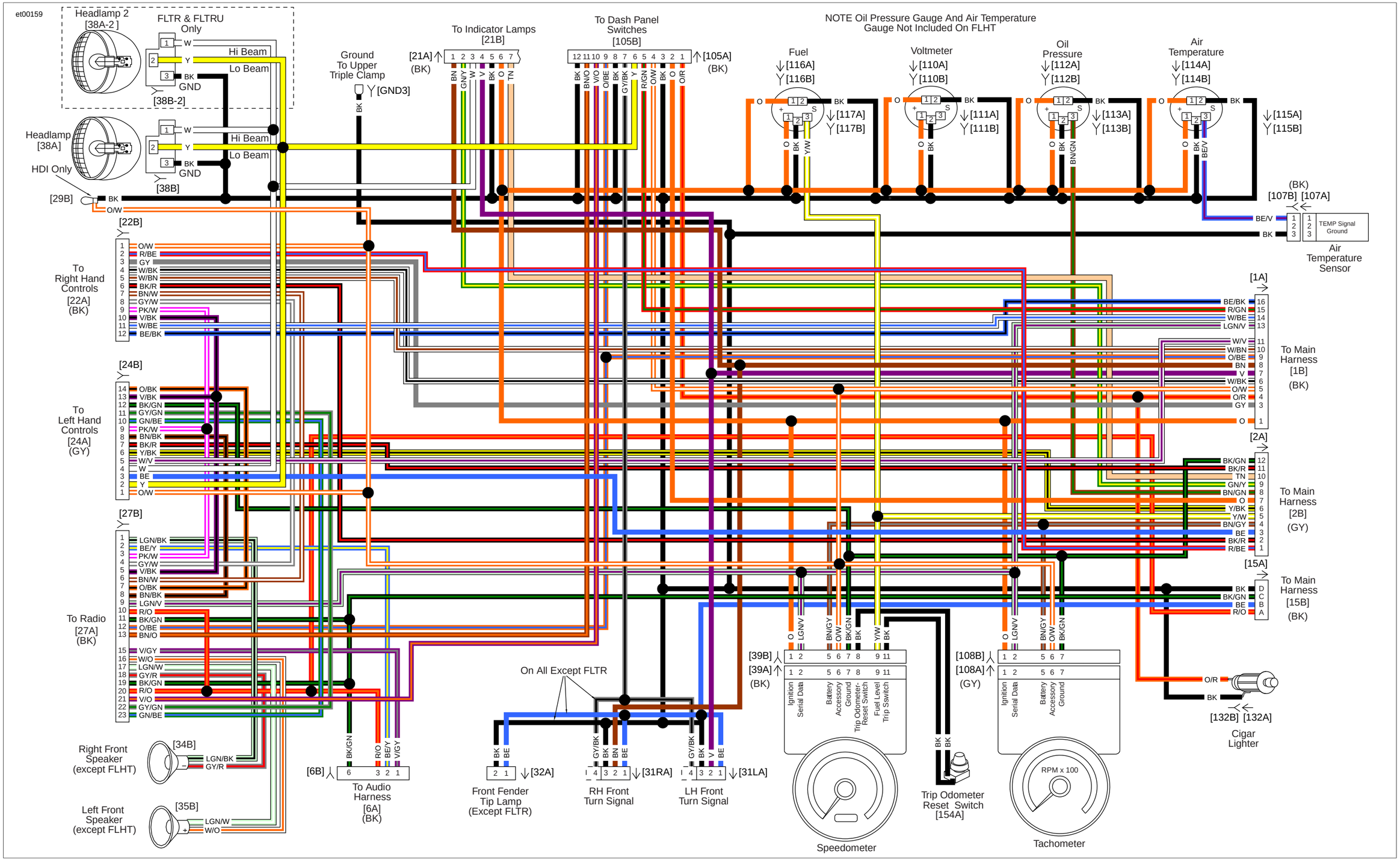


Figure B-23. INTERCONNECT HARNESS: 2009 FLHT. FLHTX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-23.
INTERCONNECT HARNESS: 2009 FLHT. FLHTX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-23.
INTERCONNECT HARNESS: 2009 FLHT. FLHTX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

et00150

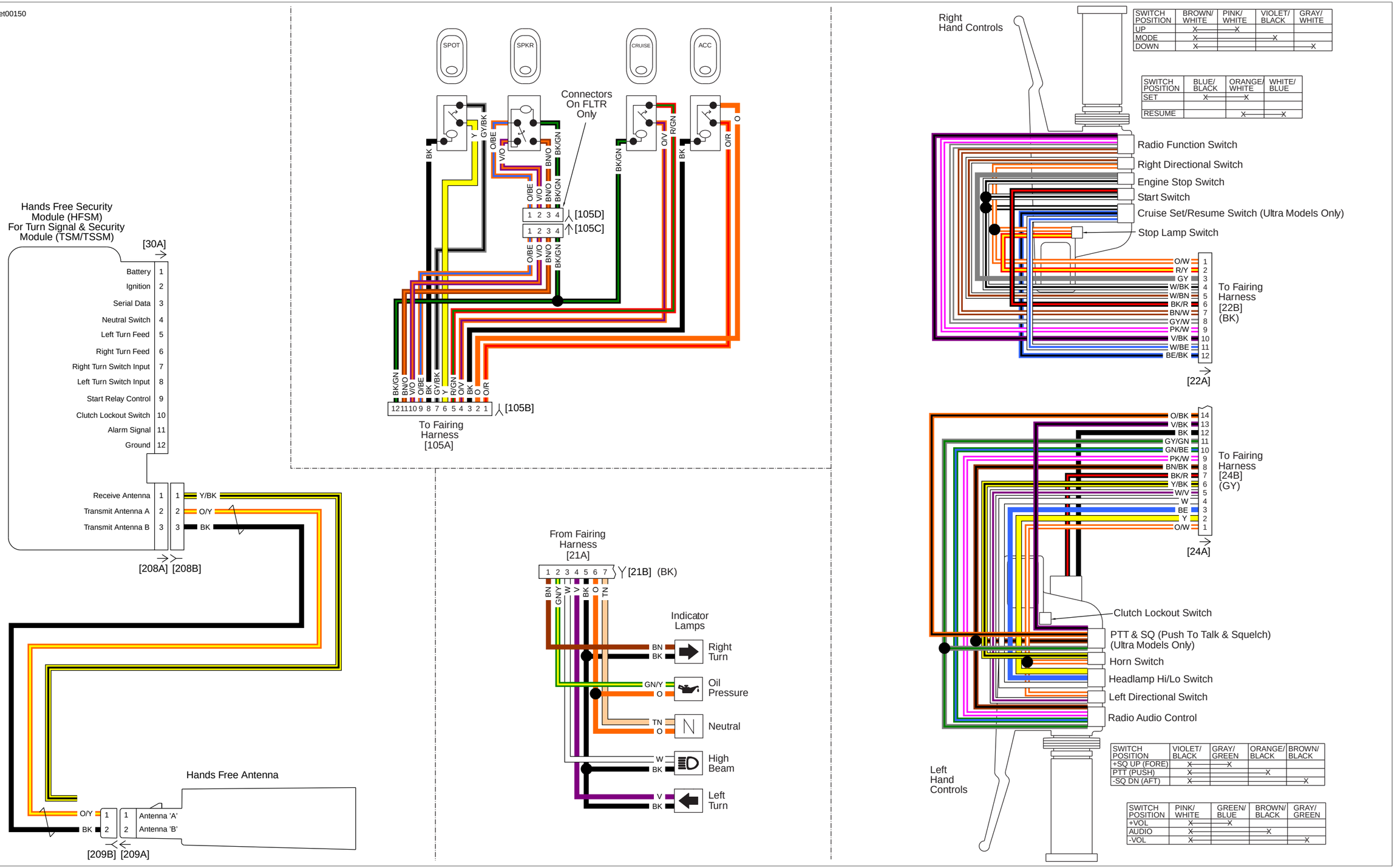
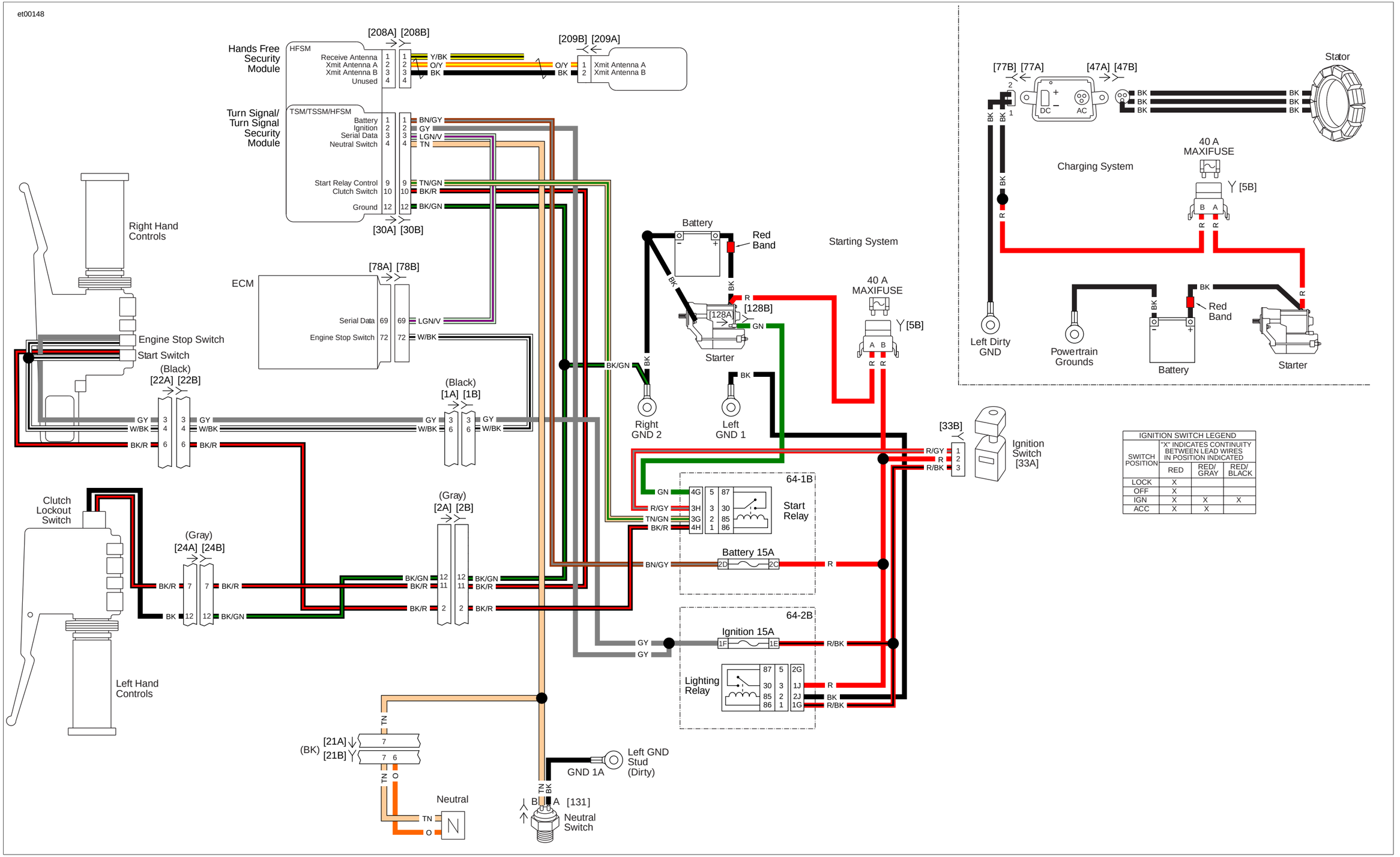


Figure B-24. HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM ANTENNA: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC INTERNATIONAL MODELS

Figure B-24.
HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM ANTENNA: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC INTERNATIONAL MODELS

Figure B-24.
HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM ANTENNA: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC INTERNATIONAL MODELS

et00148

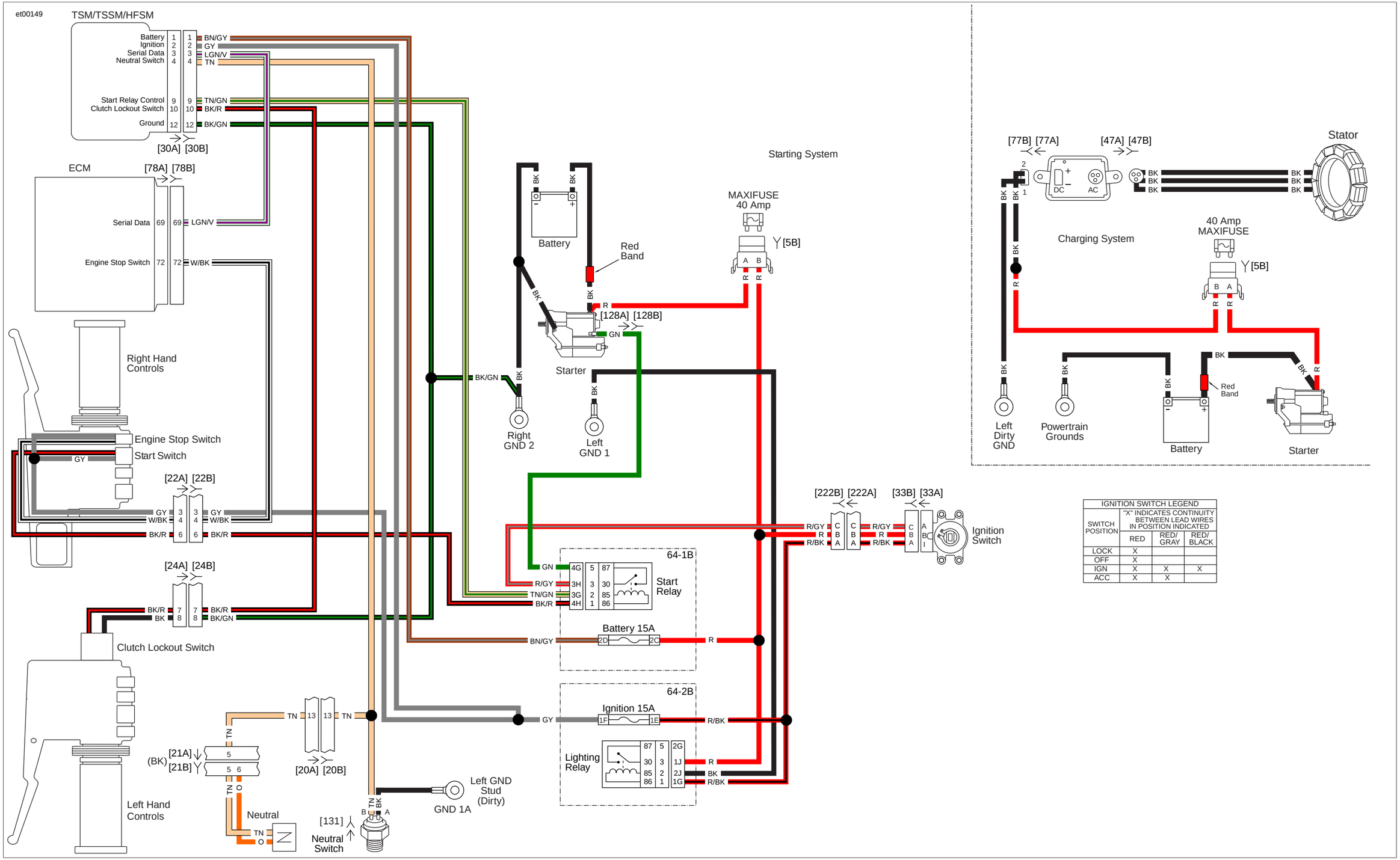


IGNITION SWITCH LEGEND			
SWITCH POSITION	"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED		
	RED	RED/ GRAY	RED/ BLACK
LOCK	X		
OFF	X		
IGN	X	X	X
ACC	X	X	

Figure B-25. STARTING AND CHARGING: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-25.
STARTING AND CHARGING: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-25.
STARTING AND CHARGING: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS



IGNITION SWITCH LEGEND

SWITCH POSITION	"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED		
	RED	RED/ GRAY	RED/ BLACK
LOCK	X		
OFF	X		
IGN	X	X	X
ACC	X	X	

Figure B-26. STARTING AND CHARGING: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-26.
STARTING AND CHARGING: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-26.
STARTING AND CHARGING: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

et00151

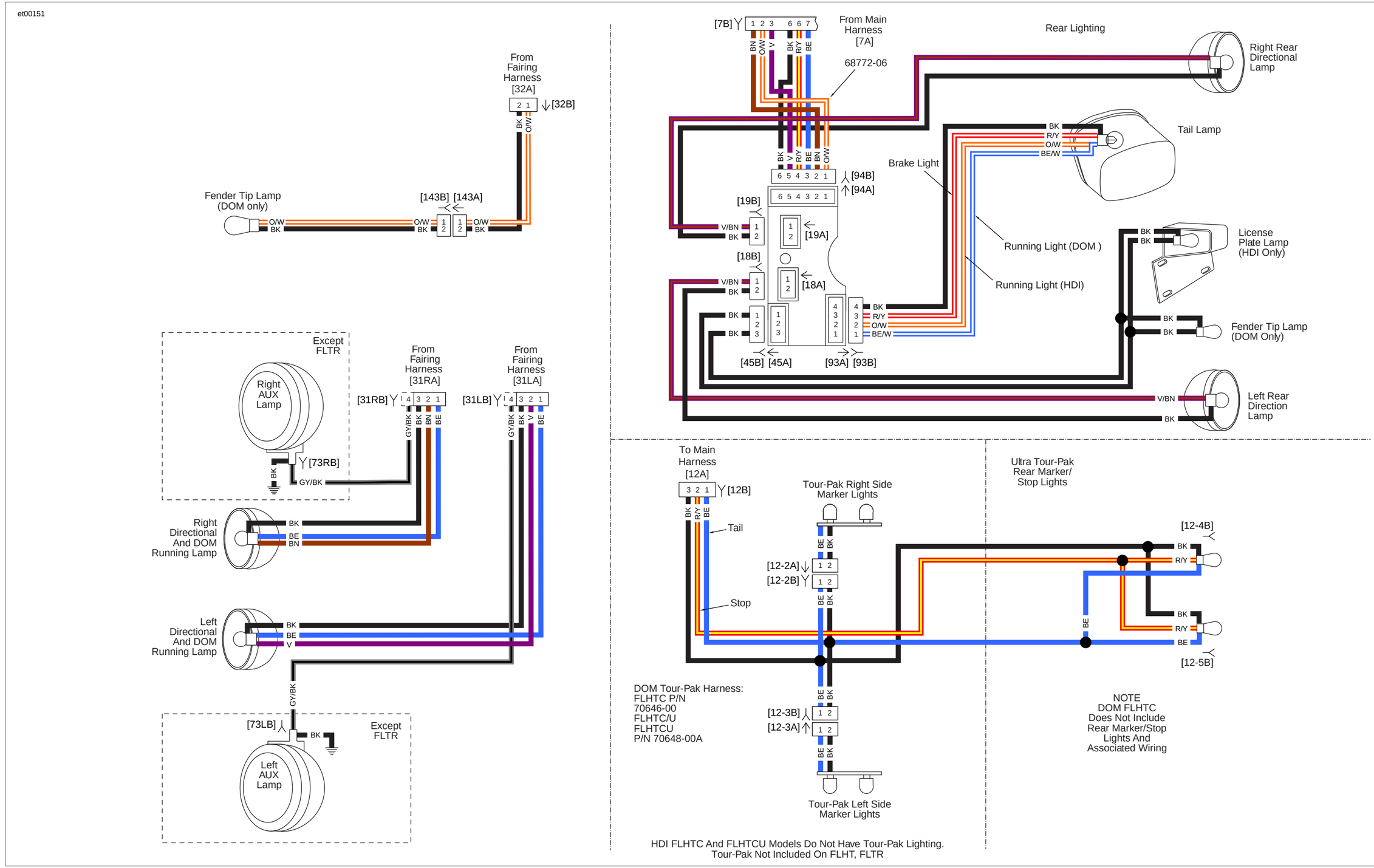


Figure B-27. TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, & TOUR-PAK LAMPS: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-27.
TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, & TOUR-PAK LAMPS: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

Figure B-27.
TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, & TOUR-PAK LAMPS: 2009 FLHT, FLHX, FLHTC, FLHTCU, & FLTR DOMESTIC & INTERNATIONAL MODELS

et00152

Hands Free Security Module (HFSM)

For Turn Signal & Security Module (TSM/TSSM)

[30A]

Battery	1
Ignition	2
Serial Data	3
Neutral Switch	4
Left Turn Feed	5
Right Turn Feed	6
Right Turn Switch Input	7
Left Turn Switch Input	8
Start Relay Control	9
Clutch Lockout Switch	10
Alarm Signal	11
Ground	12

Receive Antenna 1 — Y/BK
XMIT Antenna A 2 — O/Y
XMIT Antenna B 3 — BK

[208A] [208B]

O/Y 1 — Antenna 'A'
BK 2 — Antenna 'B'

[209B] [209A]

From Main Harness [31A]

From Main Harness [73A]

[31B] 1 2 3 4 5 6 — BK BN BE BE V BK

[73B] (BK) 2 1 — GY/BK GY/BK

[32B] (BK) 2 1 — BK O/W

Right Auxiliary Lamp

[73RB] — GY/BK

Right Directional And DOM Running Lamp

GND — BK
Turn — BN
Running DOM Only — BE

Front Fender Tip Lamp (DOM only)

O/W
BK

Left Directional And DOM Running Lamp

GND — BK
Turn — V
Running DOM Only — BE

[73LB] — GY/BK

Left Auxiliary Lamp

Chassis Grounds

Handlebar Ground — BK — Triple Clamp Grounds

Frame Ground — BK — P/N 70142-93, P/N 70101-94

Rear Lighting Harness From Main Harness [7A]

[7B] 7 6 5 3 2 1 — BE R/Y BK V O/W BN

[94B]

O/W	1
BN	2
BE	3
R/Y	4
V	5
BK	6

Fuel Gauge

BK/GN
G
F
I
E
O
Y/W
O

[117A] 1 2 4 — O Y/W BK/GN

To Main Harness

Speedometer

[39A] 1 2 3 4 5 6 7 8 9 11

1	Ignition
2	Serial Data
3	NC
4	NC
5	Battery
6	Accessory
7	Ground
8	Trip Odometer Reset Switch
9	Fuel Level
11	Trip Switch

From Main Harness [67A] And [109A]

[109B] and/or [67B] 1 2 3 4 — BK BK BK BK

Rear View Of Toggle Switch With Keyway Down

On
Off
Keyway Down
Normally Closed
Common
Normally Open
BK
BK

Accessory/Aux Lamp Switch

Right Hand Controls

Right DIR Switch
Engine Stop Switch
Start Switch Cruise
Set/Resume Switch

[22A]

Stoplight Switch

O/W	1	From Main Harness [22B] (BK)
R/Y	2	
GY	3	
W/BK	4	
W/BN	5	
BK/R	6	

FLHRC Only

[159A]

BE/BK	2	From Main Harness [159B] (BK)
W/BE	1	

[24A]

O/W	1	From Main Harness [24B] (GY)
Y	2	
BE	3	
W	4	
W/V	5	
Y/BK	6	
BK/R	7	
BK	8	

[158A]

R/GN	2	From Main Harness [158B] (GY)

FLHRC Only

Clutch Lockout Switch
Cruise On/Off Switch
Horn Switch
Lights Hi/Low Switch
Left DIR Switch

Left Hand Controls

Right Rear Directional Lamp

V/BN
BK

From Main Harness [94B]

[19B] 6 5 4 3 2 1 — [94A]

V/BN BK — 1 2 — [19A]

[18B] — V/BN BK — 1 2 — [18A]

BK BK — 1 2 3 — 1 2 3 — 4 3 2 1

[45B] [45A] [93A] [93B]

Brake Light

Tail HDI Only

Tail DOM Only

BK
R/Y
O/W
BE

Taillamp

Fendertip Lamp (DOM) License Plate Lamp (HDI)

BK
BK
V/BN
BK

Left Rear Directional Lamp

From Main Harness [21A]

[21B] (BK) 1 2 3 4 5 6 7 — V W GN/Y BN TN O BK

Indicator Lamps

BN BK	Right Turn	
GN/Y O	Oil Pressure	
TN O	Neutral	
W BK	High Beam	
V BK	Left Turn	

Figure B-28. HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMPS, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS, AND AUX LAMP/ACCESSORY SWITCHES: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-28.
HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMPS, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS, AND AUX LAMP/ACCESSORY SWITCHES: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-28.
HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMPS, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS, AND AUX LAMP/ACCESSORY SWITCHES: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

et00154

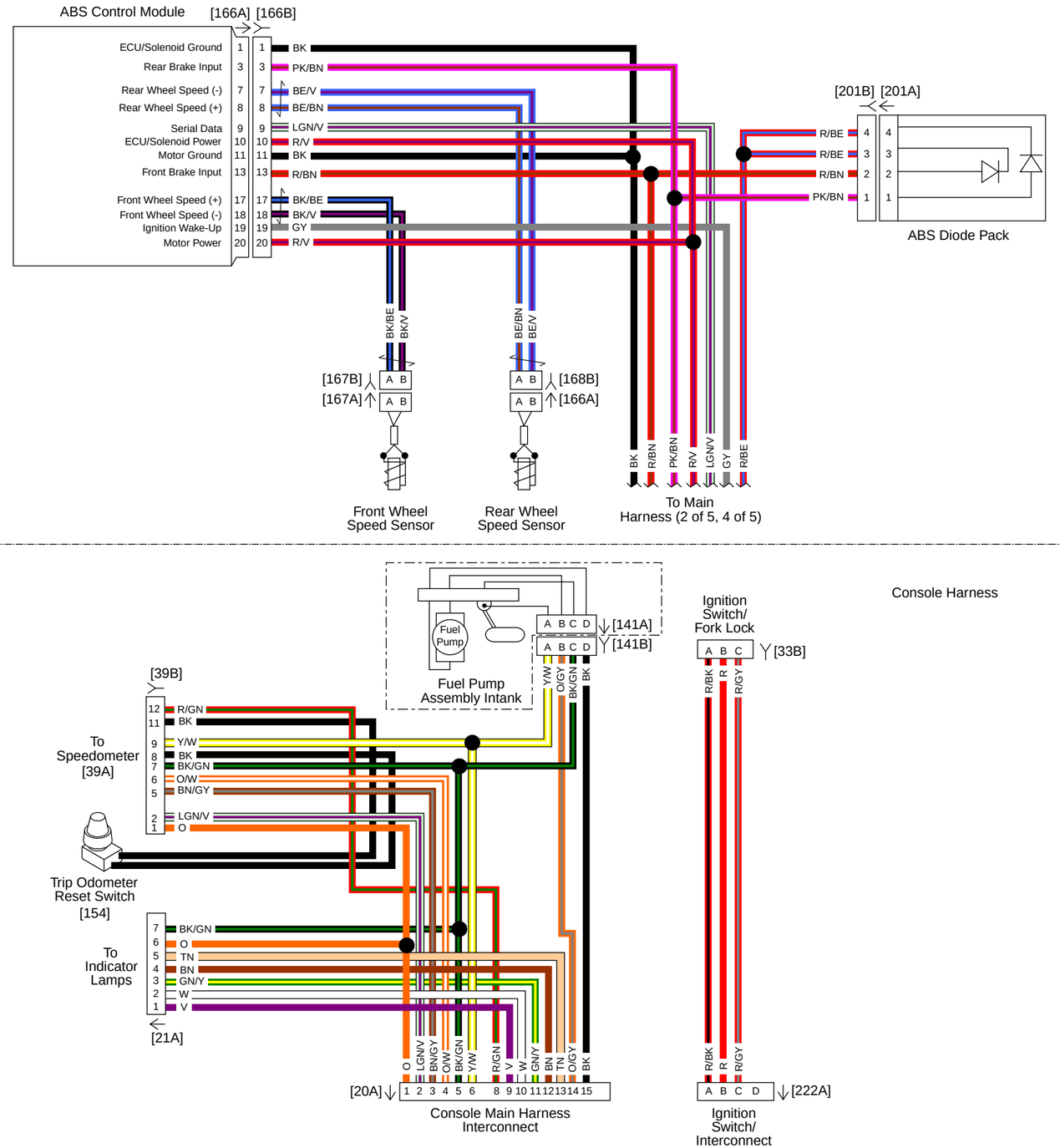


Figure B-29. CONSOLE TO MAIN HARNESS INTERCONNECT, IGNITION SWITCH INTERCONNECT AND ALL DOMESTIC & INTERNATIONAL MODELS ABS HARNESS: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-29.
CONSOLE TO MAIN HARNESS INTERCONNECT, IGNITION SWITCH INTERCONNECT AND ALL DOMESTIC & INTERNATIONAL MODELS ABS HARNESS: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

Figure B-29.
CONSOLE TO MAIN HARNESS INTERCONNECT, IGNITION SWITCH INTERCONNECT AND ALL DOMESTIC & INTERNATIONAL MODELS ABS HARNESS: 2009 FLHR & FLHRC DOMESTIC & INTERNATIONAL MODELS

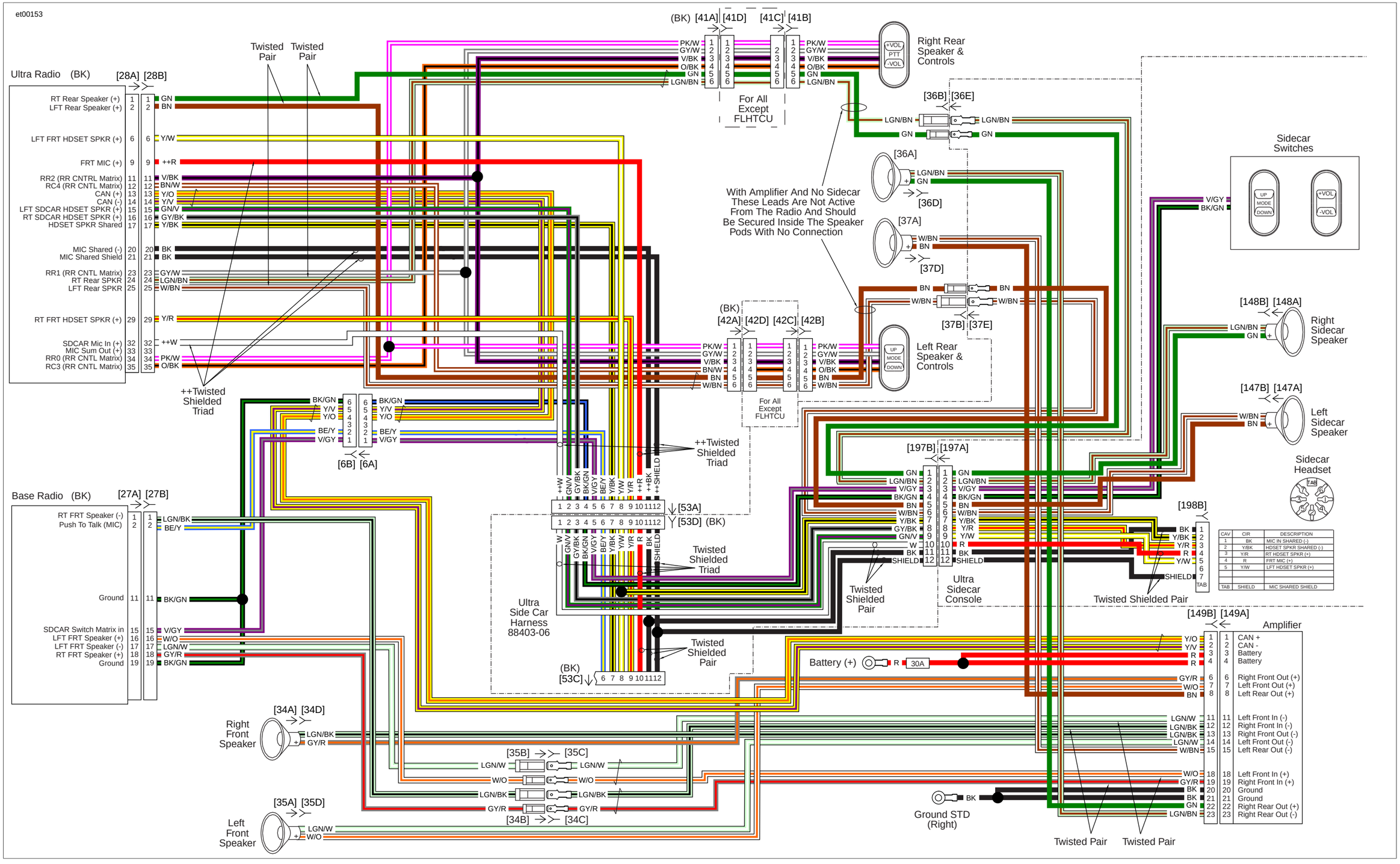
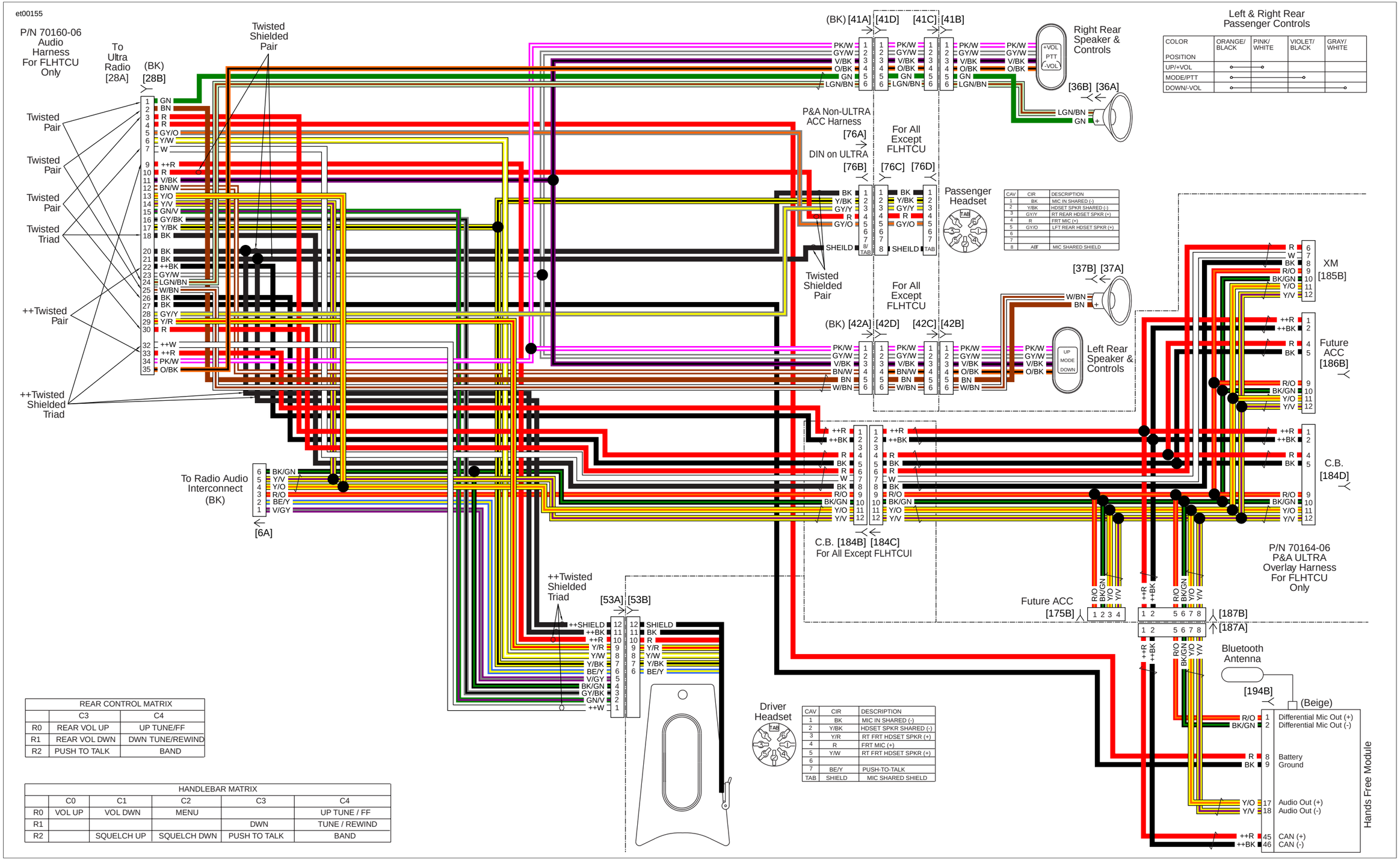


Figure B-30. 2009 Composite Ultra Audio Circuit

Figure B-30.
2009 Composite Ultra Audio Circuit

Figure B-30.
2009 Composite Ultra Audio Circuit

et00155



REAR CONTROL MATRIX

	C3	C4
R0	REAR VOL UP	UP TUNE/FF
R1	REAR VOL DWN	DWN TUNE/REWIND
R2	PUSH TO TALK	BAND

HANDLEBAR MATRIX

	C0	C1	C2	C3	C4
R0	VOL UP	VOL DWN	MENU		UP TUNE / FF
R1				DWN	TUNE / REWIND
R2		SQUELCH UP	SQUELCH DWN	PUSH TO TALK	BAND

Figure B-31. 2009 Ultra Audio Interconnect Harness

Figure B-31.
2009 Ultra Audio Interconnect Harness

Figure B-31.
2009 Ultra Audio Interconnect Harness

et00156

SWITCH POSITION	BROWN/ WHITE	PINK/ WHITE	VIOLET/ BLACK	GRAY/ WHITE
UP	X	X		
MODE	X			X
DOWN	X			X

SWITCH POSITION	VIOLET/ BLACK	GRAY/ GREEN	ORANGE/ BLACK	BROWN/ BLACK
+SQ UP (FORE)	X	X		
PTT (PUSH)	X		X	
-SQ DN (AFT)	X			X

SWITCH POSITION	PINK/ WHITE	GREEN/ BLUE	BROWN/ BLACK	GRAY/ GREEN
+VOL	X	X		
AUDIO	X		X	
-VOL	X			X

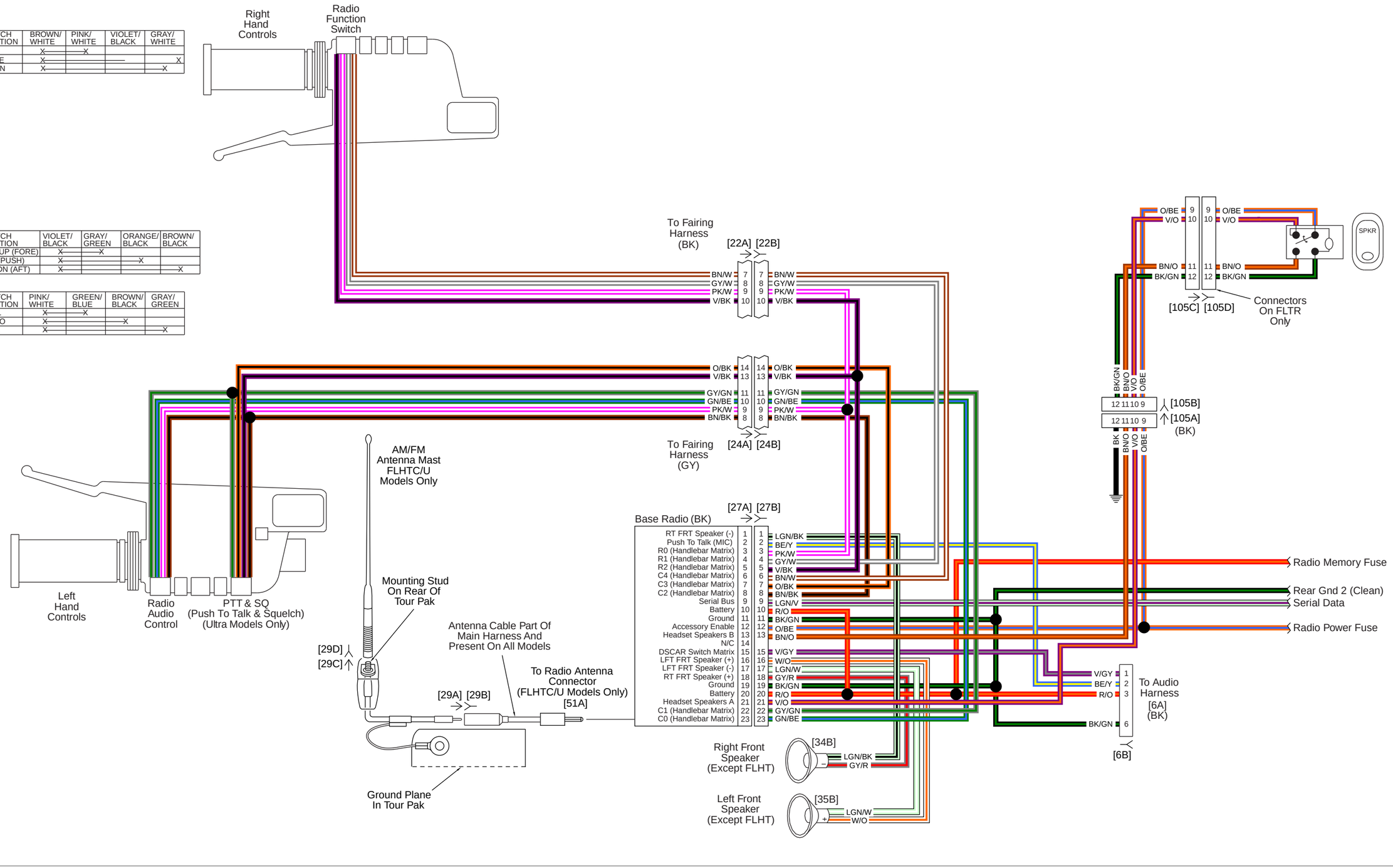


Figure B-32. 2009 Basic Radio Interconnect Circuit

Figure B-32.
2009 Basic Radio Interconnect Circuit

Figure B-32.
2009 Basic Radio Interconnect Circuit

et00174

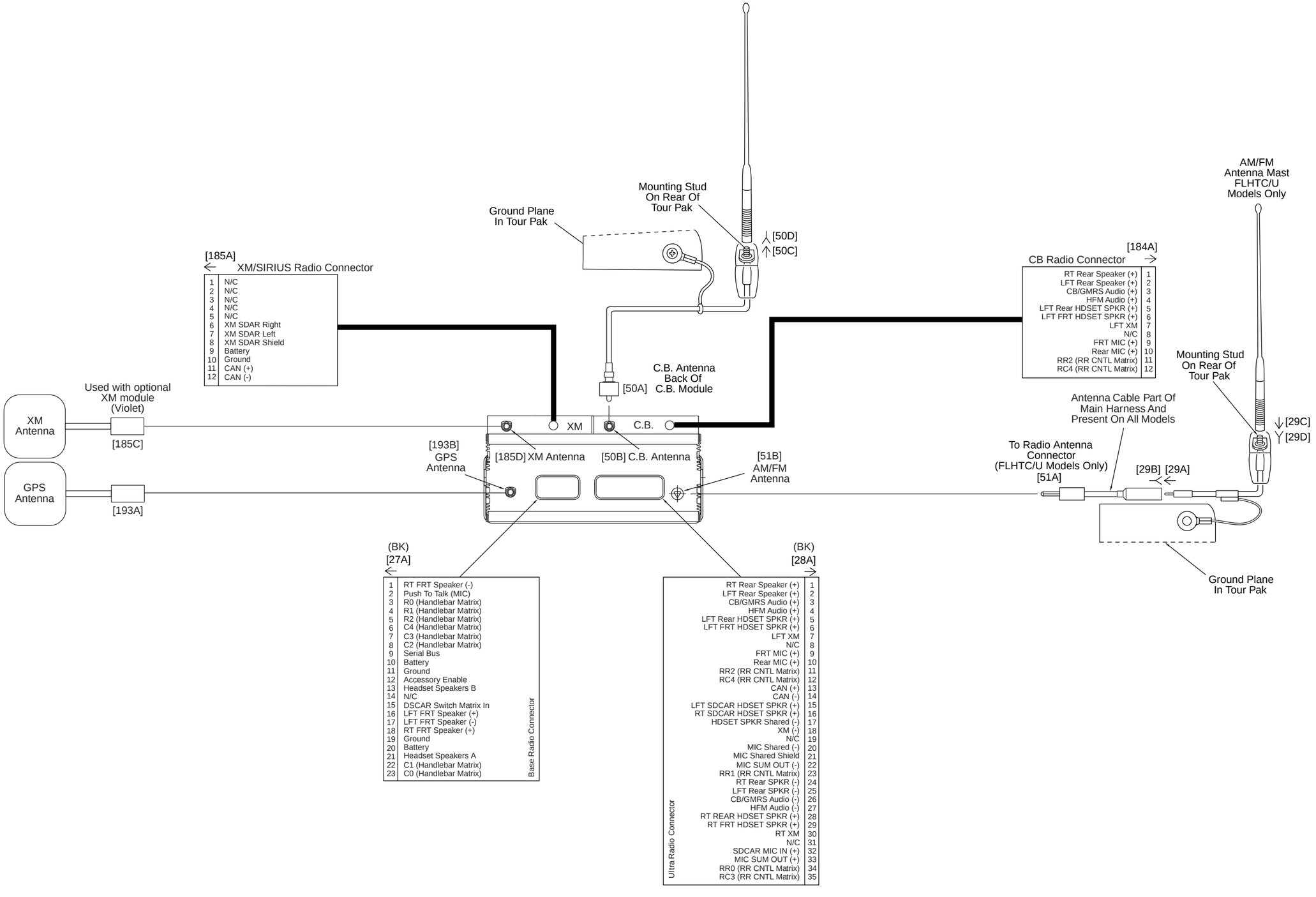


Figure B-33. 2009 Ultra Radio RF Interconnect Circuit

Figure B-33.
2009 Ultra Radio RF Interconnect Circuit

Figure B-33.
2009 Ultra Radio RF Interconnect Circuit

TABLE OF CONTENTS

SUBJECT **PAGE NO.**

C.1 METRIC CONVERSION.....C-1
C.2 FLUID CONVERSIONS.....C-2
C.3 TORQUE CONVERSIONS.....C-3

DIGITAL TECHNICIAN® II
HARLEY-DAVIDSON®

NOTES

METRIC CONVERSION C.1

CONVERSION TABLE

Table C-1. Metric Conversions

MILLIMETERS to INCHES (MM x 0.03937 = IN)								INCHES to MILLIMETERS (IN x 25.40 = MM)							
mm	in	mm	in	mm	in	mm	in	in	mm	in	mm	in	mm	in	mm
.1	.0039	25	.9842	58	2.283	91	3.582	.001	.025	.6	15.240	1-15/16	49.21	3-5/16	84.14
.2	.0078	26	1.024	59	2.323	92	3.622	.002	.051	5/8	15.875	2	50.80	3-3/8	85.72
.3	.0118	27	1.063	60	2.362	93	3.661	.003	.076	11/16	17.462	2-1/16	52.39	3.4	86.36
.4	.0157	28	1.102	61	2.401	94	3.701	.004	.102	.7	17.780	2.1	53.34	3-7/16	87.31
.5	.0197	29	1.142	62	2.441	95	3.740	.005	.127	3/4	19.050	2-1/8	53.97	3-1/2	88.90
.6	.0236	30	1.181	63	2.480	96	3.779	.006	.152	.8	20.320	2-3/16	55.56	3-9/16	90.49
.7	.0275	31	1.220	64	2.519	97	3.819	.007	.178	13/16	20.638	2.2	55.88	3.6	91.44
.8	.0315	32	1.260	65	2.559	98	3.858	.008	.203	7/8	22.225	2-1/4	57.15	3-5/8	92.07
.9	.0354	33	1.299	66	2.598	99	3.897	.009	.229	.9	22.860	2.3	58.42	3-11/16	93.66
1	.0394	34	1.338	67	2.638	100	3.937	.010	.254	15/16	23.812	2-5/16	58.74	3.7	93.98
2	.0787	35	1.378	68	2.677	101	3.976	1/64	.397	1	25.40	2-3/8	60.32	3-3/4	95.25
3	.1181	36	1.417	69	2.716	102	4.016	.020	.508	1-1/16	26.99	2.4	60.96	3.8	96.52
4	.1575	37	1.456	70	2.756	103	4.055	.030	.762	1.1	27.94	2-7/16	61.91	3-13/16	96.84
5	.1968	38	1.496	71	2.795	104	4.094	1/32	.794	1-1/8	28.57	2-1/2	63.50	3-7/8	98.42
6	.2362	39	1.535	72	2.834	105	4.134	.040	1.016	1-3/16	30.16	2-9/16	65.09	3.9	99.06
7	.2756	40	1.575	73	2.874	106	4.173	.050	1.270	1.2	30.48	2.6	66.04	3-15/16	100.01
8	.3149	41	1.614	74	2.913	107	4.212	.060	1.524	1-1/4	31.75	2-5/8	66.67	4	101.6
9	.3543	42	1.653	75	2.953	108	4.252	1/16	1.588	1.3	33.02	2-11/16	68.26	4-1/16	102.19
10	.3937	43	1.693	76	2.992	109	4.291	.070	1.778	1-5/16	33.34	2.7	68.58	4.1	104.14
11	.4331	44	1.732	77	3.031	110	4.331	.080	2.032	1-3/8	34.92	2-3/4	69.85	4-1/8	104.77
12	.4724	45	1.772	78	3.071	111	4.370	.090	2.286	1.4	35.56	2.8	71.12	4-3/16	106.36
13	.5118	46	1.811	79	3.110	112	4.409	.1	2.540	1-7/16	36.51	2-13/16	71.44	4.2	106.68
14	.5512	47	1.850	80	3.149	113	4.449	1/8	3.175	1-1/2	38.10	2-7/8	73.02	4-1/4	107.95
15	.5905	48	1.890	81	3.189	114	4.488	3/16	4.762	1-9/16	39.69	2.9	73.66	4.3	109.22
16	.6299	49	1.929	82	3.228	115	4.527	.2	5.080	1.6	40.64	2-15/16	74.61	4-5/16	109.54
17	.6693	50	1.968	83	3.268	116	4.567	1/4	6.350	1-5/8	41.27	3	76.20	4-3/8	111.12
18	.7086	51	2.008	84	3.307	117	4.606	.3	7.620	1-11/16	42.86	3-1/16	77.79	4.4	111.76
19	.7480	52	2.047	85	3.346	118	4.645	5/16	7.938	1.7	43.18	3.1	78.74	4-7/16	112.71
20	.7874	53	2.086	86	3.386	119	4.685	3/8	9.525	1-3/4	44.45	3-1/8	79.37	4-1/2	114.30
21	.8268	54	2.126	87	3.425	120	4.724	.4	10.160	1.8	45.72	3-3/16	80.96	4-9/16	115.89
22	.8661	55	2.165	88	3.464	121	4.764	7/16	11.112	1-13/16	46.04	3.2	81.28	4.6	116.84
23	.9055	56	2.205	89	3.504	122	4.803	1/2	12.700	1-7/8	47.62	3-1/4	82.55	4-5/8	117.47
24	.9449	57	2.244	90	3.543	123	4.842	9/16	14.288	1.9	48.26	3.3	83.82	4-11/16	119.06

FLUID CONVERSIONS C.2

UNITED STATES SYSTEM

Unless otherwise specified, all fluid volume measurements in this Service Manual are expressed in United States (U.S.) units-of-measure. See below:

- 1 pint (U.S.) = 16 fluid ounces (U.S.)
- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.) = 4 quarts (U.S.) = 128 fl. oz. (U.S.)

METRIC SYSTEM

Fluid volume measurements in this Service Manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). Should you need to convert from U.S. units-of-measure to metric units-of-measure (or vice versa), refer to the following:

- fluid ounces (U.S.) x 29.574 = milliliters
- pints (U.S.) x 0.473 = liters
- quarts (U.S.) x 0.946 = liters
- gallons (U.S.) x 3.785 = liters
- milliliters x 0.0338 = fluid ounces (U.S.)
- liters x 2.114 = pints (U.S.)
- liters x 1.057 = quarts (U.S.)
- liters x 0.264 = gallons (U.S.)

BRITISH IMPERIAL SYSTEM

Fluid volume measurements in this Service Manual do not include the British Imperial (Imp.) system equivalents. The following conversions exist in the British Imperial system:

- 1 pint (Imp.) = 20 fluid ounces (Imp.)
- 1 quart (Imp.) = 2 pints (Imp.)
- 1 gallon (Imp.) = 4 quarts (Imp.)

Although the same unit-of-measure terminology as the U.S. system is used in the British Imperial (Imp.) system, the actual volume of each British Imperial unit-of-measure differs from its U.S. counterpart. The U.S. fluid ounce is larger than the British Imperial fluid ounce. However, the U.S. pint, quart, and gallon are smaller than the British Imperial pint, quart, and gallon, respectively. Should you need to convert from U.S. units to British Imperial units (or vice versa), refer to the following:

- fluid ounces (U.S.) x 1.042 = fluid ounces (Imp.)
- pints (U.S.) x 0.833 = pints (Imp.)
- quarts (U.S.) x 0.833 = quarts (Imp.)
- gallons (U.S.) x 0.833 = gallons (Imp.)
- fluid ounces (Imp.) x 0.960 = fluid ounces (U.S.)
- pints (Imp.) x 1.201 = pints (U.S.)
- quarts (Imp.) x 1.201 = quarts (U.S.)
- gallons (Imp.) x 1.201 = gallons (U.S.)

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TORQUE CONVERSIONS C.3

UNITED STATES SYSTEM

The U.S. units of torque, foot pounds and inch pounds, are used in this service manual. To convert units, use the following equations:

- foot pounds (ft-lbs) X 12.00000 = inch pounds (**in-lbs**).
- inch pounds (**in-lbs**) X 0.08333 = foot pounds (ft-lbs).

METRIC SYSTEM

All metric torque specifications are written in Newton-meters (Nm). To convert metric to United States units and United States to metric, use the following equations:

- Newton meters (Nm) X 0.737563 = foot pounds (ft-lbs).
- Newton meters (Nm) X 8.85085 = inch pounds (**in-lbs).**
- foot pounds (ft-lbs) X 1.35582 = Newton meters (Nm).
- inch pounds (**in-lbs**) X 0.112985 = Newton meters (Nm).

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GLOSSARY D.1

ACRONYMS AND ABBREVIATIONS

Table D-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
A	Amperes
AC	Alternating Current
ACC	Accessory
ACR	Automatic Compression Release
AGM	Absorbed Glass Mat (battery)
Amp	Ampere
AWG	American Wire Gauge
B+	Battery Voltage
BAS	Bank Angle Sensor
BTDC	Before Top Dead Center
C	Celsius (Centigrade)
CA	California
CAL	Calibration
CC	Cubic Centimeters
CCA	Cold Cranking Amps
CKP	Crankshaft Position
cm	Centimeter
DC	Direct Current
DLC	Data Link Connector
DOM	Domestic
DTC	Diagnostic Trouble Code
DVOM	Digital Volt Ohm Meter
ECM	Electronic Control Module
ECT	Engine Coolant Temperature
EEPROM	Electrically Erasable Programmable Read Only Memory
EFI	Electronic Fuel Injection
ET	Engine Temperature
EVAP	Evaporative Emissions Control System
F	Fahrenheit
ft-lbs	Foot-Pounds
fl oz.	Fluid Ounce
g	Gram
GAL	Gallon
GAWR	Gross Axle Weight Rating
GND	Ground (electrical)
GVWR	Gross Vehicle Weight Rating
HDI	Harley-Davidson International
H-DSSS	Harley-Davidson Smart Security System
HFSM	Hands Free Security Module
Hg	Mercury

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Table D-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
IAC	Idle Air Control
IAT	Intake Air Temperature
IC	Instrument Cluster
ID	Inside Diameter
IGN	Ignition Light/Key Switch
In.	Inch
INJ PW	Injector Pulse Width
in-lbs	Inch-Pounds
Kg	Kilogram
Km	Kilometer
kPa	Kilopascal
km/hr	Kilometers Per Hour
L	Liter
LCD	Liquid Crystal Display
LED	Light Emitting Diode
mA	Milliampere
MAP	Manifold Absolute Pressure
ml	milliliter
mm	millimeter
MPH	Miles Per Hour
ms	millisecond
Nm	Newton-Meter
N/A	Not Applicable
no.	Number
O2	Oxygen
OD	Outside Diameter
OEM	Original Equipment Manufacturer
oz	Ounce
P&A	Parts and Accessories
PN	Part Number
PSI	Pounds per Square Inch
PWM signal	Pulse Width Modulated signal
RES	Reserve
RPM	Revolutions Per Minute
SCFH	Cubic Feet per Hour at Standard Conditions
TCA	Throttle Control Actuator
TDC	Top Dead Center
TGS	Twist Grip Sensor
TP	Throttle Position
TMAP	Intake Air Temperature/Manifold Absolute Pressure
TSM	Turn Signal Module
TSSM	Turn Signal/Security Module
V	Volt

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Table D-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
VAC	Volts of Alternating Current
VDC	Volts of Direct Current
VIN	Vehicle Identification Number
VSS	Vehicle Speed Sensor

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NOTES

TSM/TSSM (JAPAN/KOREA) OVERVIEW E.1

GENERAL

TSM

The TSM has two major functions:

- control turn signals.
- serve as BAS.

TSSM

See Figure E-1. The optional, factory-installed, Harley-Davidson Factory Security System (**H-DFSS**) includes a TSSM which provides the same functions as the TSM, but also includes security and immobilization functions.

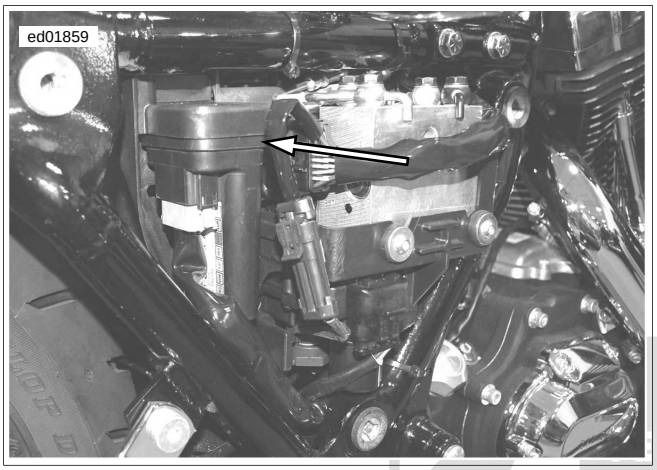


Figure E-1. TSSM (Japan/Korea)

TROUBLESHOOTING

Problems fall into at least one of five categories:

- turn signal malfunction
- bank angle (engine disable)
- clutch/neutral interlock (starter enable)
- security lamp problem
- security system malfunction

To resolve TSM/TSSM problems, four basic steps are involved. In order of occurrence, they are:

1. Retrieve DTCs using speedometer self-diagnostics. See E.10 SPEEDOMETER SELF-DIAGNOSTICS.
2. Diagnose system problems. This involves using special tools and the diagnostic flowcharts in this section.
3. Correct problems through the replacement and/or repair of the affected components.
4. After repairs are performed, validate the work. This involves clearing the DTCs and confirming proper vehicle operation as indicated by the behavior of the turn signals.

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TSM/TSSM FEATURES E.2

TURN SIGNAL FUNCTIONS

TSM/TSSM Features

See E.4 TSM/TSSM TURN SIGNAL FUNCTIONS for complete details.

- **Manual turn signal control:** Manual activation/deactivation of left and right turn signal flashing sequences.
- **Automatic turn signal cancellation:** Automatic cancellation of left and right turn signal flashing sequences based on either vehicle speed, vehicle acceleration or turn completion.
- **Emergency flashers:** Four-way left and right turn signal flashing capability.
- **Turn signal lamp diagnostics:** Self-diagnostics for short circuit and open lamp conditions on both left and right turn signal systems.

BANK ANGLE FUNCTION

See E.5 TSM/TSSM BANK ANGLE FUNCTION for complete details.

- **Emergency engine shutdown:** Monitors vehicle lean and provides engine shutdown when lean exceeds 40 degrees from vertical for more than one second.
- **Emergency outputs disable:** Monitors vehicle lean and disables turn signal lamps and starter motor when lean exceeds 40 degrees from vertical for more than one second.

CLUTCH/NEUTRAL INTERLOCK FUNCTIONS

TSM/TSSM Features

- **Disables starter:** Disables starter until either the clutch lever is pulled in or transmission neutral is selected.
- **Diagnostics:** Provides diagnostics for clutch and neutral switch faults.

SECURITY ALARM AND IMMOBILIZATION FUNCTIONS

TSSM Feature

The following information applies only to motorcycles with the security option (TSSM). See E.6 SECURITY SYSTEM FUNCTIONS (TSSM ONLY) for more information.

- **Remote arming/disarming:** See Figure E-2. Owners may enable and disable security alarm and immobilization functions with a personally carried transmitter. This transmitter is referred to as a **key fob**. Remote arming/disarming is a function of the TSSM (Japan/Korea) only.
- **Security lamp (key icon):** See Figure E-3. A lamp within the speedometer face tells the rider if the system is armed or disarmed.
- **PIN disarming:** If a key fob is not available, the TSSM allows the rider to disable the security alarm and immobilization functions if the rider knows the previously entered PIN.
- **Arming/disarming confirmation:** When the TSSM is armed, the system provides visual feedback to the rider by flashing the turn signals and sounding the optional smart siren.
- **Auto-arming:** Automatically enables the security alarm and immobilization functions within 30 seconds after the ignition switch is switched OFF.



Figure E-2. Key Fob: TSSM

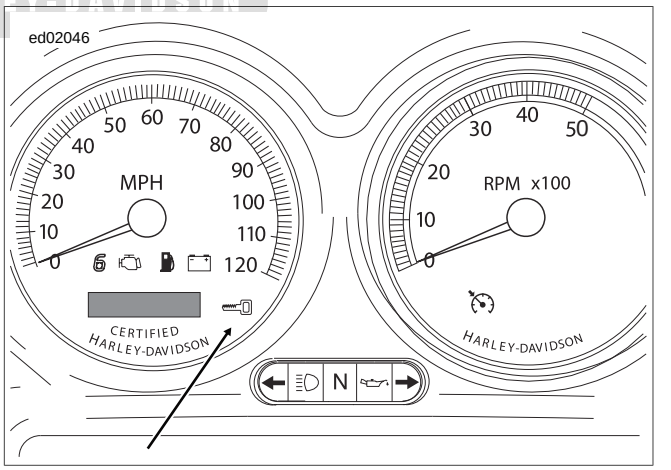


Figure E-3. Security Lamp (Key Icon - Typical)

NOTE

Motorcycles sold with a TSSM have auto-arming disabled, but it can be activated. See E.3 TSM/TSSM VEHICLE DELIVERY.

- **Transport mode:** It is possible to arm the security system without enabling the motion detector for one ignition cycle.

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This allows the vehicle to be moved in an immobilized state.

- **Starter/ignition disable:** Should the security alarm and immobilization functions be triggered by a vehicle security condition, the starter and ignition system is disabled.
- **Security system alarm:** See Figure E-4. The system alternately flashes the left and right turn signals and sounds an optional smart siren if a vehicle security condition is detected while the system is armed.



Figure E-4. Security Siren

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TSM/TSSM VEHICLE DELIVERY E.3

GENERAL

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

Setting up a vehicle TSM/TSSM depends on whether the vehicle has a TSM or the optional TSSM installed.

All motorcycles ship with the TSM/TSSM set for use **without** a sidecar installed. If a motorcycle is equipped with a TSM, no further configuration is required.

However, if a motorcycle has an optional security system (TSSM) installed, perform the following steps as necessary.

1. Configure TSSM motorcycles by assigning both key fobs to the vehicle. See E.23 TSSM MAINTENANCE, Key FOB.
2. Configure TSSM motorcycles by entering a PIN picked by the owner. The PIN allows the owner to operate the system if the key fob is lost or inoperable. Record this PIN in the Owner's Manual and instruct the customer to carry a copy.

CONFIGURING A TSSM

NOTE

Do not forget to enter a PIN for TSSM motorcycles. If a PIN is not assigned and both key fobs are lost or damaged while the motorcycle is armed, the TSSM must be replaced.

Changes to TSSM settings are made by a series of programming operations involving the ignition switch, left/right turn signal switches and key fob (security systems).

At certain steps in the programming sequence, the motorcycle may provide confirmation of settings by flashing the turn signals, turn signal indicators and/or security lamp. In addition, when programming a PIN into a TSSM system, the odometer displays the PIN to the user and dynamically updates it as the code is entered or changed.

All programming operations are listed in table format. Follow the numbered steps to configure the system. If a confirmation response is listed, wait for the confirmation before continuing to the next step. Important information pertaining to certain actions are found in the NOTES column.

SIDECAR CONFIGURATION

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

POWER DISRUPTION AND CONFIGURING

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

The TSM/TSSM will not enter configuration mode on the first attempt after battery voltage has been removed from terminal 1. This occurs after any of the following situations:

- battery disconnect or power drain.
- battery fuse removal.
- connecting BREAKOUT BOX (Part No. HD-42682)to TSM/TSSM connector.

Therefore, after all battery reconnects, modify the configuration sequence as follows.

1. Set engine stop switch to **OFF**, cycle ignition switch **IGNITION**-OFF-**IGNITION**-OFF-**IGNITION** and press left turn signal switch twice.
2. Repeat step listed above.
3. Continue with configuration sequence listed.

KEY FOB ASSIGNMENT: TSSM

Refer to Table E-1 to assign a key fob to a motorcycle equipped with a TSSM.

Set the key fob on TSSM-equipped motorcycles so it operates the alarm system on the vehicle. Complete this assignment with no pauses between steps greater than 10 seconds. Turn the ignition switch to OFF after all key fobs have been assigned. The programming mode also exits after 60 seconds has elapsed without detecting any fob sign-up messages or turn signal switch activity.

Two key fobs may be assigned to the TSSM. The first successful attempt to program a fob disables all previously assigned fobs. If a second fob is to be programmed, it must be done in the same programming sequence as the initial fob.

Table E-1. Key Fob Assignment: TSSM

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set engine stop switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed). Complete this assignment procedure with no pauses between steps greater than 10 seconds.
2	Cycle the ignition switch **IGNITION** - OFF - **IGNITION** - OFF - **IGNITION**.		

Table E-1. Key Fob Assignment: TSSM

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
3	Press **left** turn switch twice and release.	One to four flashes turn signals and indicators depending on vehicle configuration (see E.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects).	One flash - Worldwide TSM, no security. Two flashes - Japan/Korea configuration TSSM.
4	Press **right** turn switch once and release.	One flash turn signals and indicators.	
5	Press **left** turn switch once and release.	Two flashes turn signals and indicators.	
6	Press and hold **key fob** button until confirmation is received.	Two flashes turn signals and indicators.	This may take 10-25 seconds.
7	If you have two key fobs, press and hold button on second **key fob** until confirmation is received.	Two flashes turn signals and indicators.	Optional step.
8	Turn ignition switch to **OFF**.		

PIN ENTRY: TSSM

NOTE

Do not forget to enter a PIN for TSSM vehicles. If a PIN is not assigned and the key fob is lost or damaged while the vehicle is armed, the TSSM must be replaced.

The TSSM PIN consists of five digits. Each digit can be any number from 1 through 9. There can be no zeros (0) in the PIN. The PIN **must** be used to disarm the security system in case the key fob becomes unavailable.

Refer to Table E-2 to enter an initial PIN with no PIN previously installed. The procedure listed uses 3-1-3-1-3 as the desired PIN.

NOTE

For better security, do not use 3-1-3-1-3 as a PIN. It is shown as an example only.

Have the owner decide on a five-digit PIN. The code is programmed using the turn signal switches and key fob. Keep a record of the PIN in a secure place such as the Owner's Manual.

- When programming the PIN, the security lamp flashes to provide feedback when entering each digit. The odometer also displays the PIN and the change dynamically.
- The number of security lamp flashes corresponds to the number currently selected for a given digit. Therefore, the lamp may flash 1-9 times depending on the number entered. The five-digit PIN changes in the odometer window and the active digit blinks.
- Press the left turn switch one time to increment each digit.
- Quickly press the key fob button twice to advance to the next digit.

NOTE

The programming mode exits upon turning the ignition switch to OFF, or if no turn signal switch/key fob button activity occurs for 60 seconds. No data is saved for partial configuration attempts if entering a PIN for the first time. If a PIN has previously been entered, the user can change any digit or group of digits.

Table E-2. Entering an Initial TSSM PIN (Example: 3-1-3-1-3) with No PIN Previously Entered

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set engine stop switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed). This assignment procedure **must** be completed with no pauses between steps greater than 10 seconds.
2	Cycle the ignition switch **IGNITION**-OFF-**IGNITION**-OFF-**IGNITION**.		
3	Press **left** turn switch twice and release.	One to four flashes turn signals and indicators depending on vehicle configuration (see E.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects).	One flash - Worldwide TSM, no security. Two flashes - Japan/Korea configuration TSSM.

Table E-2. Entering an Initial TSSM PIN (Example: 3-1-3-1-3) with No PIN Previously Entered

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
4	Quickly press **key fob** button twice and release.	One flash turn signals and indicators Odometer displays current five-digit PIN (five dashes if no code entered) first digit blinks.	Vehicle is in PIN entry mode ready to enter or modify first digit.
5	Press **left** turn switch once and release.	Security lamp flashes 1-9 times if code was previously entered.	A lack of confirmation flashes indicates no digit is entered.
6	Press and release **left** turn switch to advance through the digits. In this example, press and release three times.	Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected. In this example, the blinking digit displayed is 3 and the security lamp flashes three times.	You have selected 3 as a number for the first digit.
7	Quickly press **key fob** button twice and release.	Two flashes turn signals and indicators second digit in odometer display blinks.	You have confirmed 3 as a number for the first digit and have advanced to entering the second digit.
8	Press **left** turn switch once and release.	None.	A lack of confirmation flashes indicates no digit is entered.
9	Press and release **left** turn switch to advance through the digits. In this example, perform this step one time.	Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected. In this example, the blinking digit displayed is 1 and the security lamp flashes once.	You have selected 1 as a number for the second digit.
10	Quickly press **key fob** button twice and release.	Three flashes turn signals and indicators third digit in odometer display blinks.	You have confirmed 1 as a number for the second digit and have advanced to entering the third digit.
11	Press **left** turn switch once and release.	None.	A lack of confirmation flashes indicates no digit is entered.
12	Press and release **left** turn switch to advance through the digits. In this example, repeat this step three times.	Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected. In this example, the blinking digit displayed is 3 and the security lamp flashes three times.	You have selected 3 as a number for the third digit.
13	Quickly press key fob button twice and release.	Four flashes turn signals and indicators fourth digit in odometer display blinks.	You have confirmed 3 as a number for the third digit and have advanced to entering the fourth digit.
14	Press **left** turn switch once and release.	None.	A lack of confirmation flashes indicates no digit is entered.
15	Press and release **left** turn switch to advance through the digits. In this example, perform this step one time.	Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected. In this example, the blinking digit displayed is 1 and the security lamp flashes once.	You have selected 1 as a number for the fourth digit.
16	Quickly press **key fob** button twice and release.	Five flashes turn signals and indicators fifth digit in odometer display blinks.	You have confirmed 1 as a number for the fourth digit and have advanced to entering the fifth digit.
17	Press **left** turn switch once and release.	None.	A lack of confirmation flashes indicates no digit is entered.

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Table E-2. Entering an Initial TSSM PIN (Example: 3-1-3-1-3) with No PIN Previously Entered

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
18	Press and release **left** turn switch to advance through the digits. In this example, repeat this step three times.	Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected. In this example, the blinking digit displayed is 3 and the security lamp flashes three times.	You have selected 3 as a number for the fifth digit.
19	Quickly press **key fob** button twice and release.	One flash turn signals and indicators first digit in odometer display blinks.	You have confirmed 3 as a number for the fifth digit and have gone back to the first digit.
20	Turn ignition switch to OFF.		
21	Write down code in Owner's Manual.		
22	Arm the security system and attempt to disarm using PIN entry. Refer to Table E-8.		

CHANGING THE PIN: TSSM

If a PIN has been previously entered, the security lamp flashes the equivalent digit, and the odometer displays the existing PIN with the active digit blinking. Each additional press of the left turn switch increments the digit.

- To advance from 5 to 6, press and release the left turn switch once.
- To advance from 8 to 2, press and release the left turn switch 3 times (9-1-2).

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TSM/TSSM TURN SIGNAL FUNCTIONS E.4

GENERAL

The TSM/TSSM turn signal feature has several modes:

- automatic cancellation
- manual cancellation
- four-way flashing
- diagnostics mode

The turn signals cannot be activated or deactivated when the ignition switch is in the ACCESS position. The turn signals can only be activated or deactivated with the ignition switch in the IGNITION position.

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

AUTOMATIC CANCELLATION

Press the left or right turn switch to activate automatic turn signal cancellation. There is no need to hold the turn switch in when approaching the turn. The TSM/TSSM will not cancel the signal before the turn is actually completed.

- When the directional switch is released, the system starts a 20 count. As long as the vehicle is traveling at more than 7 MPH (11 km/h), the directional always cancels after 20 flashes, if the system does not recognize any other input.
- If the vehicle speed drops to 7 MPH (11 km/h) or less, including stopped, the directionals continue to flash. Counting resumes when vehicle speed reaches 8 MPH (12 km/h) and automatically cancels when the count total equals 20 as stated above.
- The turn signals cancels within 2 seconds upon turn completion. A sensor inside the TSM/TSSM cancels the signal after the vehicle has been returned to an upright position.

NOTE

The bank angle cancellation function has an automatic calibration feature. Ride the motorcycle for 0.25 mi (0.4 km) at steady speeds (upright) to calibrate the system. Performance of bank angle function may not be optimal until this calibration is performed. This self-calibration is performed automatically every time the vehicle is started and ridden.

MANUAL CANCELLATION

If you want to stop the turn signals from flashing, briefly press the turn signal switch a second time.

If you are signalling to turn in one direction and you press the switch for the opposite turn signal, the first signal is cancelled and the opposite side begins flashing.

FOUR-WAY FLASHING

Use the following method to activate the four-way flashers:

1. With the ignition switch on and the security system disarmed (models with security only), press the left and right turn signal switches at the same time.
2. Turn the ignition switch off and arm the security system if present and desired. The four-way flashers continue for two hours.
3. To cancel four-way flashing, disarm the security system if necessary, turn the ignition switch on and press the left and right turn signal switches at the same time.

This system allows a stranded vehicle to be left in the four-way flashing mode and secured until help is found.

If the security system is disarmed while the four-way flashers are active, the lights flash as follows:

1. TSSM stops four-way flashing mode. Motorcycle sits for 1 second with turn signals off.
2. TSSM performs disarming confirmation (one flash).
3. Motorcycle sits for 1 second with turn signals off.
4. Motorcycle restarts four-way flashing mode.

DIAGNOSTICS MODE

The TSM/TSSM measures the current when the turn signals are used. If there is a burned out light bulb on one side, the remaining light and the corresponding turn signal indicator flash at double the normal rate starting with the fifth flash.

Other diagnostic conditions monitored include:

- short circuit in the turn signal wiring
- open circuit in the turn signal wiring
- stuck turn signal switch

NOTES

- *A stuck turn signal switch disables the automatic turn signal cancellation feature.*
- *If a stuck switch is detected, hold the left and right turn signal switches in for more than 1 second to activate the four-way flashers.*

See E.8 DIAGNOSTIC TROUBLE CODES (DTC) for more information.

TSM/TSSM BANK ANGLE FUNCTION E.5

GENERAL

The turn signals, starter motor, ECM, fuel pump, and ignition coil will be disabled in the event the vehicle is tipped over.

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

OPERATION

The engine shuts off automatically if the vehicle tilts more than 40 degrees from vertical for longer than 1 second. The engine automatically shuts off even if the tilt occurs at a very slow speed. The odometer displays tIP when a tip over condition is detected.

To restart the motorcycle after shutdown has occurred:

1. Return the motorcycle to an upright position.
2. Cycle the ignition switch to OFF-IGNITION before restarting.

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SECURITY SYSTEM FUNCTIONS (TSSM ONLY) E.6

GENERAL

Security System Operation

The TSSM provides security and immobilization functions not found on the TSM. The TSSM disables the starter and ignition system. Additional functions include the ability to alternately flash the left and right turn signals and sound a siren (if equipped) if a theft attempt is detected.

Conditions that activate the security system when system is armed include:

- **Detecting tampering of the ignition circuit:** Turn signals flash three times, optional siren chirps once and then turns off. If the tampering continues, a second warning activates after 4 seconds. Continued tampering causes the alarm to activate for 30 seconds and then turn off. The two warnings/alarm cycle is repeated for each tampering incident.
- **Detecting vehicle movement:** Turn signals flash three times, optional siren chirps once and then turns off. If the vehicle is not returned to its original position, a second warning activates after 4 seconds. If the vehicle is not returned to its original position, the alarm activates for 30 seconds then turns off. The two warnings/alarm cycle may repeat a maximum of 10 times with a 10 second pause between alarm cycles.
- **Detecting that a battery or ground disconnect has occurred while armed:** Siren, if installed, activates its self-alarm mode. Turn signals will not flash.

See E.7 ARMING/DISARMING (TSSM ONLY) for more information.

NOTE

Always disarm the TSSM before removing or disconnecting the battery to prevent the siren (if installed) from activating. If the TSSM is in auto-arming mode, disarm the system and disconnect the battery, or remove the battery fuse before the 30 second arming period expires.

Security System Options: TSSM

The following options are only available on the TSSM unit: alarm sensitivity, auto-arming feature, and storage mode.

Default settings for the TSSM include:

- solo vehicle configuration.
- medium motion sensitivity on alarm sensitivity.
- all vehicles are shipped with auto-arming disabled.
- storage mode set to 10 days.

ALARM SENSITIVITY: TSSM

Sensitivity

The TSSM has four sensitivity settings: extremely low, low, medium or high. The selection picked controls the sensitivity of the security system in regards to motion detection.

To set alarm sensitivity, refer to Table E-3.

Table E-3. TSSM Alarm Sensitivity

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set engine stop switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed).
2	Cycle the ignition switch **IGNITION**-OFF-**IGNITION**-OFF-**IGNITION**.		
3	Press **left** turn switch twice and release.	Two flashes turn signals and indicators depending on vehicle configuration (See E.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects).	Two flashes - Japan/Korea configuration TSSM
4	Press and hold **key fob** button until confirmation is received.	One flash turn signals and indicators.	
5	Press **left** turn switch once and release.	Turn signals and indicators flash to indicate option selected.	One flash - extremely low Two flashes - low sensitivity Three flashes - medium sensitivity Four flashes - high sensitivity
6	Press and release **left** turn switch to advance through options.	Turn signals and indicators flash to indicate option selected.	One flash - extremely low Two flashes - low sensitivity Three flashes - medium sensitivity Four flashes - high sensitivity
7	Turn ignition switch to OFF.		

Transport Mode

It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be picked up and moved in an armed state. In this mode, any attempt to hot-wire the vehicle triggers the security system.

- To enter the transport mode, refer to Table E-4.
- To exit from transport mode and return the system to normal operation/functions, disarm the system using either the key fob or PIN.

NOTE

Transport mode is especially useful when working on the motorcycle. If it is not used, the alarm activates under many typical service activities.

Table E-4. Transport Mode: TSSM

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set engine stop switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed).
2	Turn ignition switch to **IGNITION**.		
3	Press and hold **key fob** button until confirmation is received.	Three flashes turn signals and indicators.	
4	Turn ignition switch to OFF.		
5	Press and hold **key fob** button until confirmation is received.	Three flashes turn signals and indicators.	The vehicle can be moved without tripping the alarm.

AUTO-ARMING FUNCTION: TSSM

Auto-arming causes the system to automatically arm itself (no key fob needed) within 30 seconds after the ignition switch is turned off. During this period, the security lamp stays on solid to indicate auto-arming is starting up.

The vehicle may be moved during these 30 seconds without triggering the alarm. However, any motion after that period triggers the security alarm. Upon expiration of the auto-arming period, the turn signals flash twice, the security lamp begins to flash and the siren (if equipped) chirps twice.

The TSSM allows remote arming via the key fob at any time. However, if the system is remotely disarmed (with the key fob) but the ignition switch is not turned on within 30 seconds, the system rearms itself when auto-arming is enabled.

Japan and Korea motorcycles have auto-arming disabled by default. However, the feature may be enabled if the customer desires.

When auto-arming is disabled, use the key fob to arm the security system. To set the auto-arming function, refer to Table E-5.

Table E-5. Selecting TSSM Auto-Arming Function

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set engine stop switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed).
2	Cycle the ignition switch **IGNITION**-OFF-**IGNITION**-OFF-**IGNITION**.		
3	Press **left** turn switch twice and release.	Two flashes turn signals and indicators (see E.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects).	Two flashes - Japan/Korea configuration TSSM
4	Press and hold key fob button until confirmation is received.	One flash turn signals and indicators.	
5	Press and hold **key fob** button until confirmation is received.	Two flashes turn signals and indicators.	
6	Press **left** turn switch once and release.	Turn signals and indicators flash to indicate option selected.	One flash - auto-arming disabled Two flashes - auto-arming enabled
7	Press and release **left** turn switch to advance through options.	Turn signals and indicators flash to indicate option selected.	
8	Turn ignition switch to OFF.		

STORAGE MODE: TSSM

The TSSM has a special mode for long term storage. This mode prevents the security system from draining the battery after a period of days (10, 20, 60 or infinite) without any ignition switch activity.

- If the TSSM is set to infinite, the system will not go into storage mode.
- Vehicles enter storage mode whether the security system is armed or disarmed.
- If set to 20 days or greater, the customer must use an approved trickle charger to keep the battery from discharging.

In storage mode, all alarm functions remain active but the receiver is shut down and will not respond to the key fob. The vehicle is immobilized because the starter motor and ECM are disabled. When the storage mode is entered, the security lamp stops flashing to conserve power.

To wake up the TSSM from storage mode, turn the ignition switch on. This triggers a warning/alarm if the system was previously armed. Use the key fob or PIN to disarm the system and stop the alarm.

To set the storage mode preferences, refer to Table E-6.

Table E-6. Storage Mode Preferences: TSSM

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set engine stop switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed).
2	Cycle the ignition switch **IGNITION**-OFF-**IGNITION**-OFF-**IGNITION**.		
3	Press **left** turn switch twice and release.	Two flashes turn signals and indicators depending on vehicle configuration (see E.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects).	Two flashes - Japan/Korea configuration TSSM
4	Press and hold **key fob** button until confirmation is received.	One flash turn signals and indicators.	
5	Release and then hold **key fob** button until confirmation is received.	Two flashes turn signals and indicators.	
6	Release and then hold **key fob** button until confirmation is received.	Three flashes turn signals and indicators.	
7	Press **left** turn switch once and release.	Turn signals and indicators flash to indicate option selected.	One flash - 10 days Two flashes - 20 days Three flashes - 60 days Four flashes - Infinite
8	Press **left** turn switch to advance through options.	Turn signals and indicators flash to indicate option selected.	One flash - 10 days Two flashes - 20 days Three flashes - 60 days Four flashes - Infinite
9	Turn ignition switch to OFF.		

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

ARMING/DISARMING (TSSM ONLY) E.7

GENERAL

There are two methods to arm the security system:

- using the key fob.
- using auto-arming. See E.6 SECURITY SYSTEM FUNCTIONS (TSSM ONLY).

NOTE

The vehicle cannot be armed with the ignition switch turned to IGNITION.

There are two ways to disarm the system:

- using the key fob. This method works in all situations **except** before turning ignition switch to IGNITION when TSSM storage mode is activated.
- using a PIN.

SECURITY LAMP

The security lamp within the speedometer provides feedback to the rider confirming armed or disarmed status. Refer to Table E-7.

Table E-7. Security Lamp Status: TSSM

LAMP	MODE
Does not flash.	No security system (TSM), security system not armed or storage mode active.
Flashes every second.	Ten minute timeout after failed PIN entry attempt or a battery reconnect has occurred while armed.
Flashes every 2 seconds.	Security system armed.
Flashes four times a second.	PIN entry mode.
Stays on solid with ignition switch turned off.	Auto-arming is starting up. You have 30 seconds before system is armed.
Stays on solid with ignition switch turned to IGNITION.	If solid for more than 4 seconds after ignition switch is turned to IGNITION, a current DTC is present.

USING KEY FOB: TSSM

General

The TSSM reception range for the key fob signal depends on a specific receiver pattern.

NOTE

Environmental and geographic conditions may affect signal range.

Arming the System

1. Hold key fob horizontal at waist level.
2. Point key fob at the front of the vehicle.
3. Hold down the key fob button until the system responds with two turn signal flashes.

Disarming the System

1. Hold key fob horizontal at waist level.
2. Point key fob at the front of the vehicle.
3. Quickly press the key fob button twice. The system responds with one turn signal flash.

NOTE

Disarming function may require practice. Press the key fob button twice within 1.5 seconds to send the disarm command. The action is very similar to double-clicking a computer mouse. Light quick taps work best; very hard or very slow taps are less likely to work.

Troubleshooting

If the key fob button has been pressed numerous times while away from the vehicle, the fob may fall out of synchronization with the TSSM. If this happens, the TSSM might fail to recognize the key fob's commands.

To solve this problem, press and hold the key fob button for 10-15 seconds until the security system responds with two turn signal flashes. After confirmation, you may resume normal fob operation.

USING THE PIN

General

The PIN consists of five digits entered using the left and right turn signal switches. Each digit can be any number from 1-9. The PIN is intended to be used to disarm the motorcycle in case the key fob becomes unavailable or inoperable.

See E.3 TSM/TSSM VEHICLE DELIVERY to set a PIN.

Disarming the System

If you make an error while disarming the TSSM using a PIN, the alarm activates for 30 seconds after the last digit is entered. After a failed attempt, the security lamp flashes once every second for 10 minutes. **During this time, the vehicle will not accept any attempt to enter a PIN.** Refer to Table E-8.

Table E-8. Disarming TSSM with the PIN (Example: 3-1-3-1-3)

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set engine stop switch to **OFF**.		
2	Turn ignition switch to **ACCESS**.		

Table E-8. Disarming TSSM with the PIN (Example: 3-1-3-1-3)

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
3	Hold **both** turn switches in until confirmation.	Security lamp blinks at fast rate.	System is ready for PIN entry.
4	Enter first digit of code (3) by pressing **left** turn switch three times.		
5	Press **right** turn switch once.		Serves as "enter" key for first digit.
6	Enter second digit of code (1) by pressing **left** turn switch once.		
7	Press **right** turn switch once.		Serves as "enter" key for second digit.
8	Enter third digit of code (3) by pressing **left** turn switch three times.		
9	Press **right** turn switch once.		Serves as "enter" key for third digit.
10	Enter fourth digit of code (1) by pressing **left** turn switch once.		Serves as "enter" key for fourth digit.
11	Press **right** turn switch once.		
12	Enter fifth digit of code (3) by pressing **left** turn switch three times.		System is disarmed. You may use the vehicle or program another key fob.
13	Press **right** turn switch once.	Security lamp stops blinking.	

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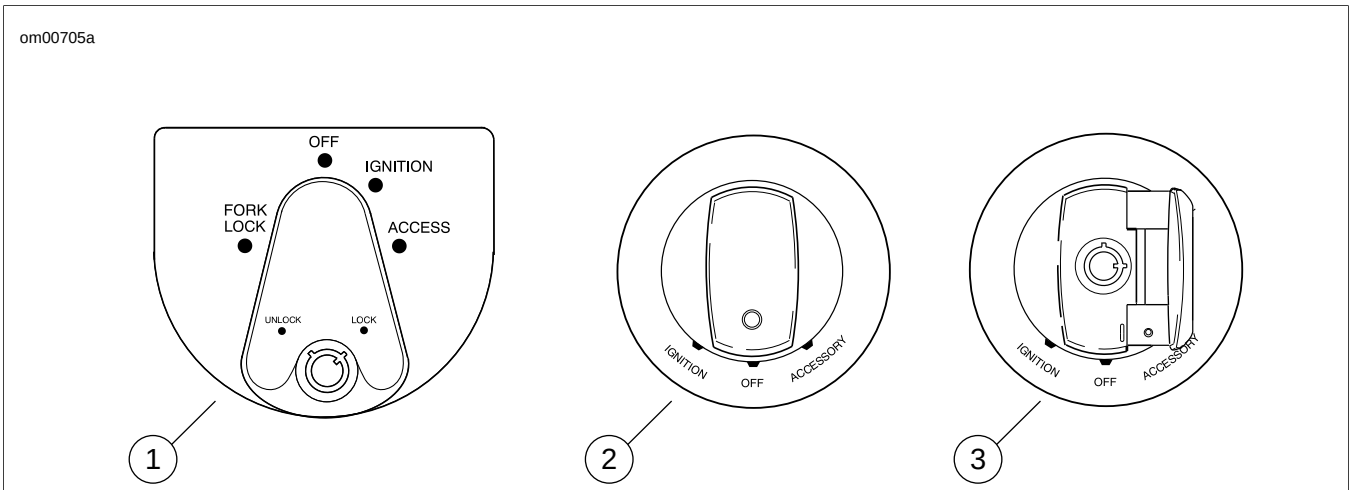
DIAGNOSTIC TROUBLE CODES (DTC) E.8

TSM/TSSM

To diagnose system problems, start by observing the behavior of the security lamp.

NOTES

- *See Figure E-5. Key on means that the ignition switch is turned to IGNITION and the engine stop switch is set to RUN (although the engine is not running).*
- *See Figure E-6. When the ignition switch is turned IGNITION, the security lamp illuminates for approximately four seconds and then turns off.*
- *If the security lamp is not illuminated at key on or if it fails to turn off after the initial 4 second period, the speedometer may need to be replaced. See E.10 SPEEDOMETER SELF-DIAGNOSTICS. If BUS Er is displayed on the odometer, it may take up to 20 seconds for the security lamp to illuminate.*
- *The security lamp illuminates for 8 seconds after the bulb check if historic DTCs are present. The security lamp stays on if current DTCs are set. If a historic DTC is present, the security lamp illuminates for two ignition cycles or until the DTC is cleared manually.*



1. **All except FLHR models**
2. **All FLHR models (cover shown closed)**
3. **All FLHR models (cover shown open)**

Figure E-5. Ignition Switch: Touring Models

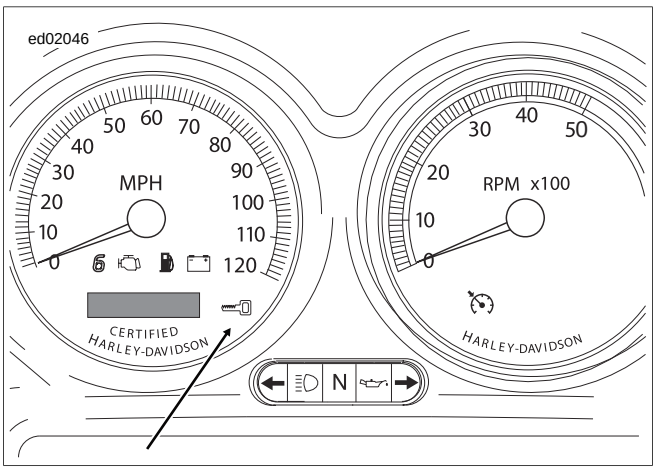


Figure E-6. Security Lamp (Key Icon - Typical)

1. See Figure E-7. After the lamp turns off after being illuminated for the first 4 second period, one of three events may occur:
 a. The lamp remains off. This indicates there are no current fault conditions or stored historic DTCs currently detected by the TSSM.
 b. The lamp stays off for only 4 seconds and then comes back on for an 8 second period. This indicates a historic DTC is stored, but no current DTC exists.
 c. If the lamp remains on beyond the 8 second period, a current DTC exists.
2. See E.8 DIAGNOSTIC TROUBLE CODES (DTC), Code Types for a complete description of DTC formats.

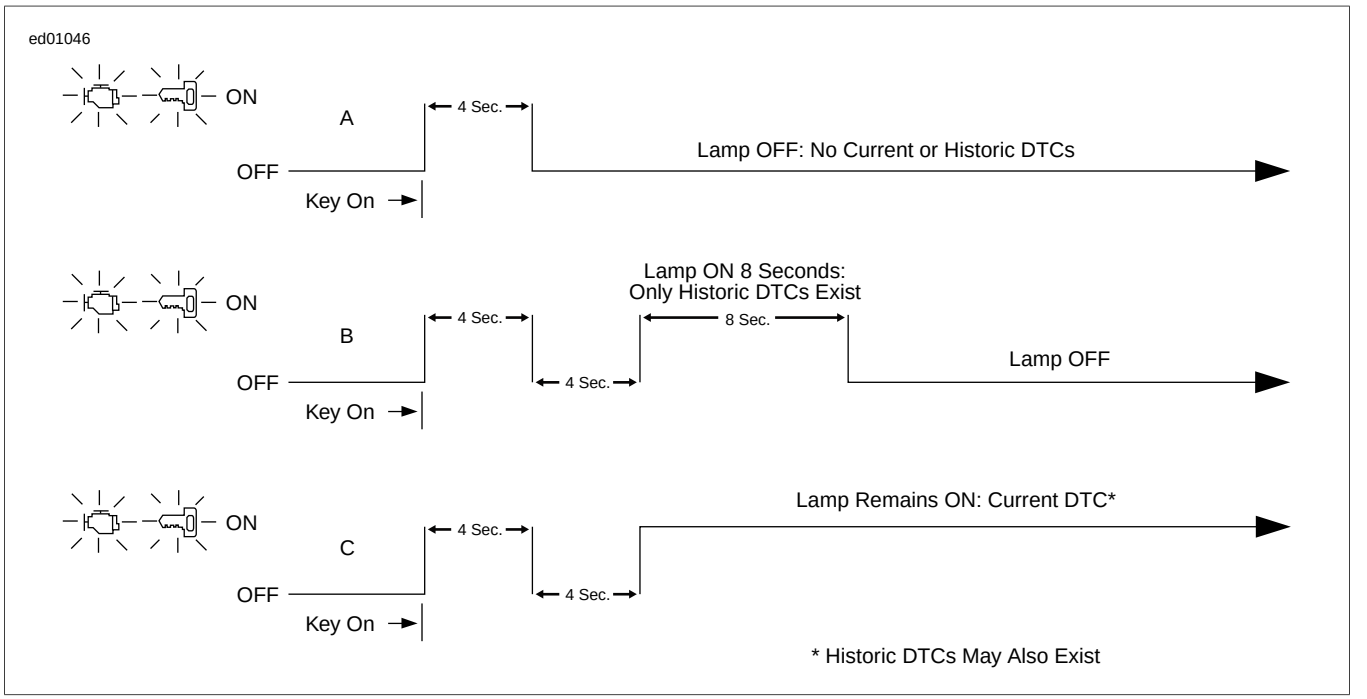


Figure E-7. Security Lamp Operation

CODE TYPES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

There are two types of DTCs: current and historic. If a DTC is stored, it can be read using either a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650) or speedometer self-diagnostics. See E.10 SPEEDOMETER SELF-DIAGNOSTICS.

NOTES

- *Speedometer self-diagnostics displays both current and historic DTCs. To differentiate between current and historic DTCs, use DIGITAL TECHNICIAN II (Part No. HD-48650).*
- *All DTCs reside in the memory of the ECM, TSM/TSSM, odometer or tachometer until the DTC is cleared by use of the speedometer self-diagnostics. See E.10 SPEEDOMETER SELF-DIAGNOSTICS.*
- *A historic DTC is also cleared after a total of 50 ignition cycles has elapsed. After the 50 ignition cycles retention period, the DTC is automatically erased from memory providing that no subsequent faults of the same type are detected in that period.*

Current

Current DTCs are those which are present during the current ignition cycle. See the appropriate flowcharts for solutions.

Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes historic, rather than a current DTC. For example, intermittent output shorts can become typical historic DTCs.

Historic DTCs are stored for 50 ignition cycles after any DTC was last set as current to assist in the diagnosis of intermittent faults. On the 50th cycle, the DTC clears itself. The security lamp only indicates the existence of historic DTCs for two ignition cycles.

It is important to note that historic DTCs exist whenever the system indicates the existence of a current fault. See E.8 DIAGNOSTIC TROUBLE CODES (DTC), Multiple Diagnostic Trouble Codes if multiple DTCs are found.

Diagnostic charts are designed for use with current DTCs and as a result they frequently suggest part replacement. When diagnosing an historic DTC the charts can be helpful but should not lead to part replacement without verification the part is faulty.

RETRIEVING DIAGNOSTIC TROUBLE CODES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The TSM/TSSM supports two levels of diagnostics.

- The most sophisticated mode uses DIGITAL TECHNICIAN II (Part No. HD-48650).
- The second mode requires using odometer self diagnostics. Speedometer, tachometer (if equipped), TSM/TSSM and ECM DTCs can be accessed and cleared. See E.10 SPEEDOMETER SELF-DIAGNOSTICS.

MULTIPLE DIAGNOSTIC TROUBLE CODES

While it is possible for more than one fault to occur and set more than one DTC, there are several conditions which may result in **one** fault setting **multiple** DTCs:

Serial data DTCs U1016, U1255, U1300 and U1301 may be accompanied by other DTCs. **Always** correct the serial data DTCs before resolving the other DTCs.

Refer to Table E-9. This table gives most TSM/TSSM DTCs a priority ranking.

Table E-9. TSM/TSSM Diagnostic Trouble Codes (DTCs) and Fault Conditions

PRIORITY	DTC	FAULT CONDITION	SOLUTION
1	U1300	Serial data low	E.21 DTC U1300, U1301 OR BUS ER.
2	U1301	Serial data high	E.21 DTC U1300, U1301 OR BUS ER.
3	U1016	Loss of ECM serial data	E.20 DTC U1016.
4	U1255	Serial data error	E.20 DTC U1016.
5	B1135	Accelerometer failed	E.17 DTC B1135.
6	B1151	Sidecar Bank Angle Sensor (BAS) short-to-ground	E.18 DTC B1151, B1152, B1153
7	B1152	Sidecar Bank Angle Sensor (BAS) short-to-battery	E.18 DTC B1151, B1152, B1153
8	B1153	Sidecar Bank Angle Sensor (BAS) high	E.18 DTC B1151, B1152, B1153
NOTE Sidecar DTCs apply only to Touring models equipped with sidecars, If DTCs B1151, B1152 and/or B1153 are present on non-sidecar equipped motorcycles, the TSM/TSSM is not properly configured.			
9	B1154	Clutch switch input short-to-ground	E.19 DTC B1154, B1155.
10	B1155	Neutral switch input short-to-ground	E.19 DTC B1154, B1155.
11	B1134	Start relay output high	E.16 DTC B1134.
12	B1121	Left turn lamp output fault	E.13 TSM/TSSM TURN SIGNAL ERRORS: B1121, B1122, B1141.
13	B1122	Right turn lamp output fault	E.13 TSM/TSSM TURN SIGNAL ERRORS: B1121, B1122, B1141.
14	B0563	Battery voltage high	E.14 DTC B0563.
15	B1131	Alarm output low	E.15 DTC B1131, B1132.
16	B1132	Alarm output high	E.15 DTC B1131, B1132.
17	B1141	Ignition switch low/open	E.13 TSM/TSSM TURN SIGNAL ERRORS: B1121, B1122, B1141.

INITIAL DIAGNOSTIC CHECK: TSM/TSSM E.9

GENERAL

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-48650	DIGITAL TECHNICIAN II

To locate faulty circuits or other system problems, follow the diagnostic flowcharts. For a systematic approach, always begin with E.9 INITIAL DIAGNOSTIC CHECK: TSM/TSSM, Initial Diagnostics. Read the general information and then work your way through the flowchart box by box.

Diagnostic Notes

If a numbered circle appears adjacent to a flowchart box, then more information is offered in the diagnostic notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual where information on the location and removal of components may be obtained.

Circuit Diagram/Wire Harness Connector Table

When working through a flowchart, refer to the illustrations, the associated circuit diagram and the wire harness connector table as necessary. The wire harness connector table for each circuit diagram identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a BREAKOUT BOX (Part No. HD-42682) and a DVOM are required. See E.11 BREAKOUT BOX: TSM/TSSM or 3.12 BREAKOUT BOX: TSM/HFSM.

To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Job/Time Code Values

Some charts may contain warranty job/time codes. Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

Reprogramming ECM

Diagnostic charts frequently suggest ECM replacement. In the event an ECM needs to be replaced, it must be reprogrammed using DIGITAL TECHNICIAN II (Part No. HD-48650). See your dealer. Password learn procedure must also be performed. See E.22 TSM/TSSM: PASSWORD LEARN.

INITIAL DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Tips

- If speedometer reads BUS Er with the ignition switch turned on (engine stop switch at RUN with the engine off), check data bus for an open or short to ground between DLC [91A] terminal 3 and ECM connector [78B] terminal 69, TSSM connector [30B] terminal 3, speedometer connector [39B] terminal 2, radio connector [27] terminal 9 (if equipped), ABS connector [166] terminal 9 (if equipped), or tachometer connector [108B] terminal 2 (if equipped).
- Check for an open diagnostic test terminal between DLC [91A] terminal 3 and TSM/TSSM connector [30B] terminal 3. With ignition switch turned on, serial data bus voltage should be 0.6-0.8 Volt. The range of acceptable voltage is 0-7.0 Volts.
- To identify intermittents, wiggle vehicle harness while performing steps in the Initial Diagnostic Check flowcharts.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness connector [39B] and speedometer connector [39A] using INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601). See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.
2. Compare TSM/TSSM system behavior to symptoms in Table E-10.

All TSM/TSSM DTCs are listed in Table E-11.

Table E-10. Symptoms That May Not Set DTCs

SYMPTOM	SOLUTION
Fails to disarm	E.12 FAILS TO DISARM (TSSM ONLY).
Turn signal will not cancel or cancels erratically	E.13 TSM/TSSM TURN SIGNAL ERRORS: B1121, B1122, B1141.
Turn signal flashes double normal rate, all bulbs good	E.13 TSM/TSSM TURN SIGNAL ERRORS: B1121, B1122, B1141.

Other DTCs

See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER for any DTCs related to the speedometer.

See 4.5 INITIAL DIAGNOSTIC CHECK: EFI for any DTCs related to the ECM.

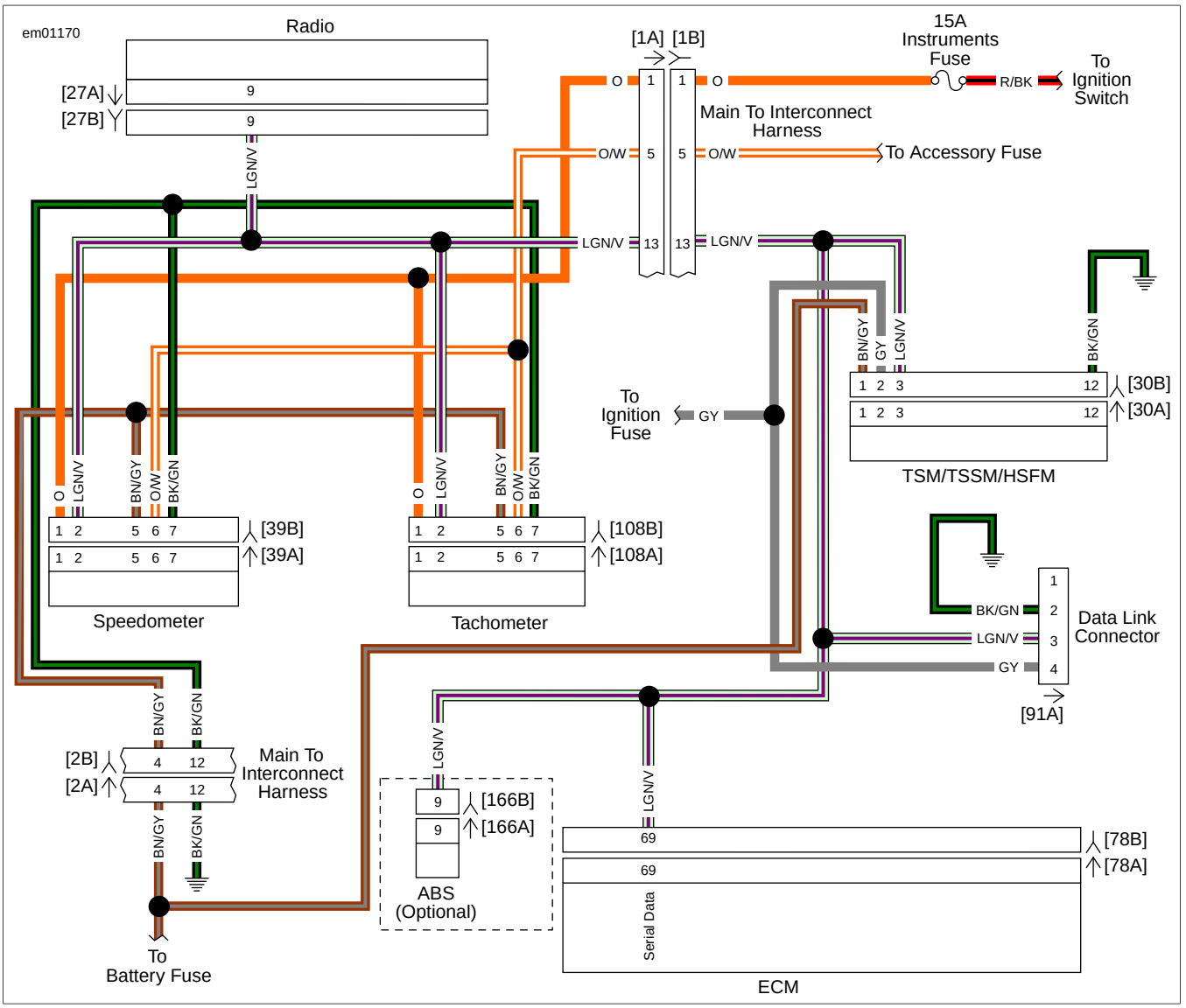


Figure E-8. Initial Diagnostic Check (FLHX, FLHT/C/U, FLTR)

Table E-11. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side below radio
[2]	Main to interconnect harness	ALL	12-place Molex (Gray)	Inner fairing - left radio support bracket
[27]	Radio	All	23-place Amp	Inner fairing - back of radio (right side)
[30]	TSM/TSSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHT/C	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
[78]	ECM	All	73-place Packard	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover

Table E-11. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[108]	Tachometer	FLHT/C	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)
[166]	ABS module (if equipped)	All	20-place Molex	Under right side cover

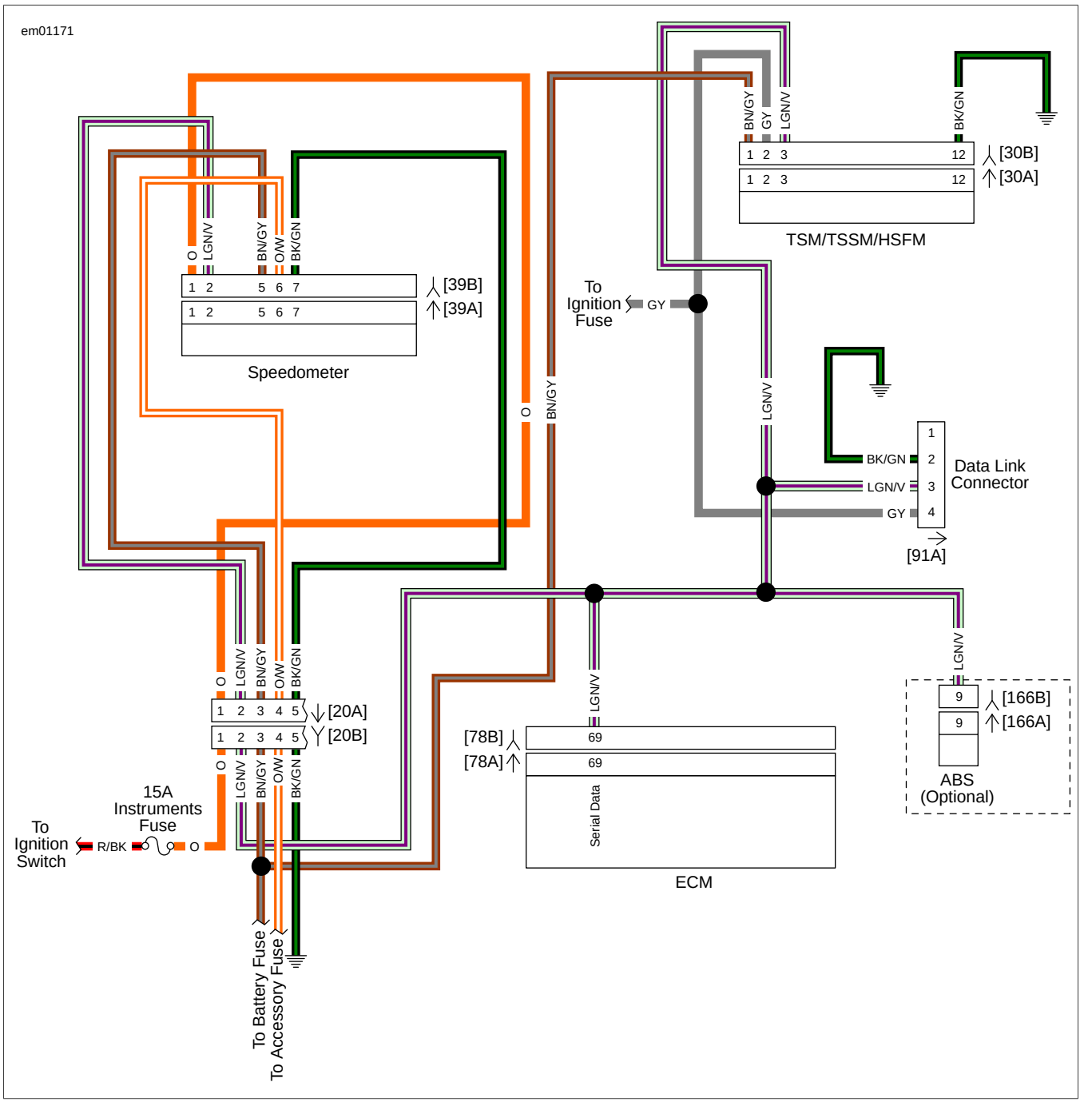


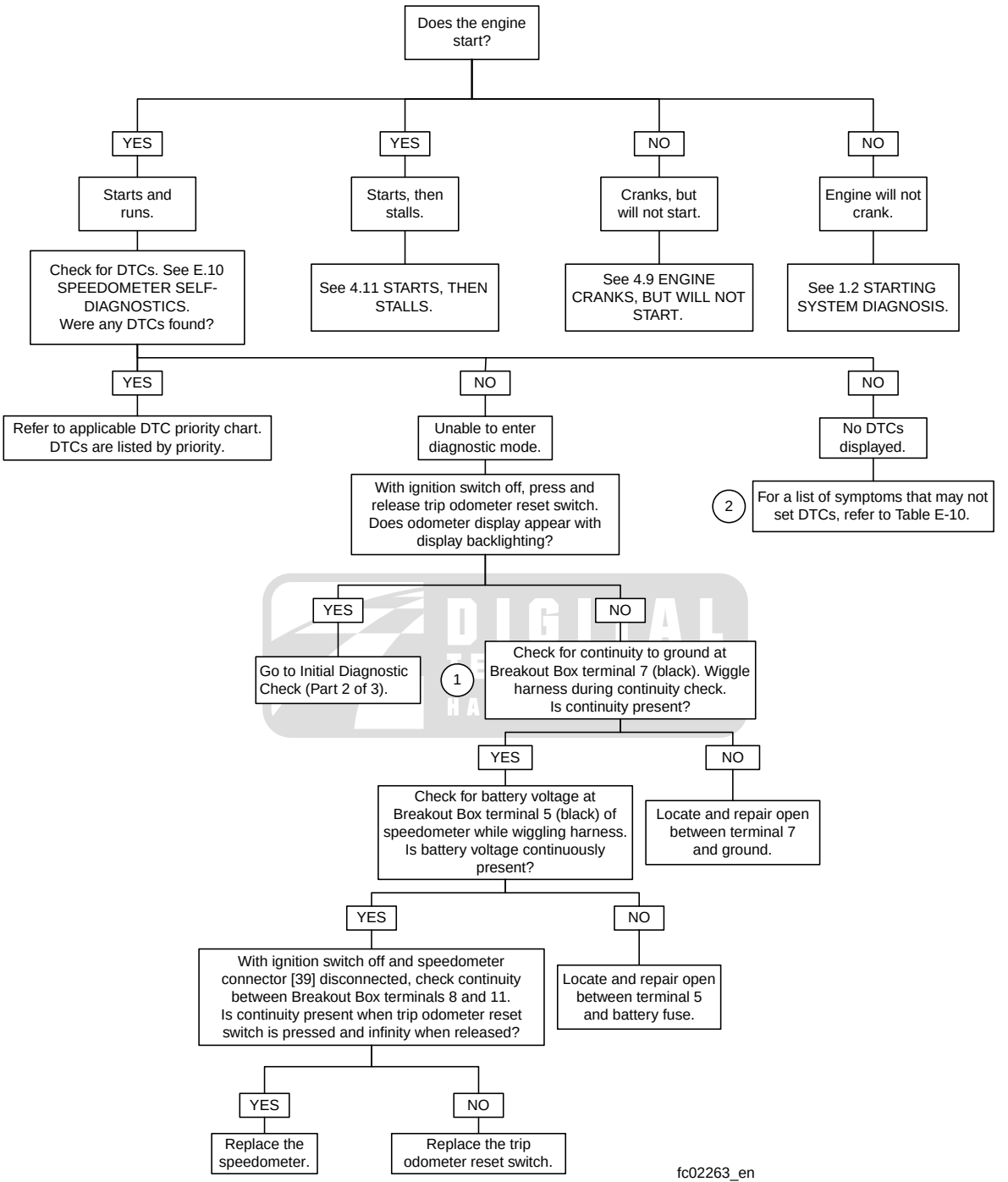
Figure E-9. Initial Diagnostic Check (FLHR/C)

Table E-12. Wire Harness Connectors

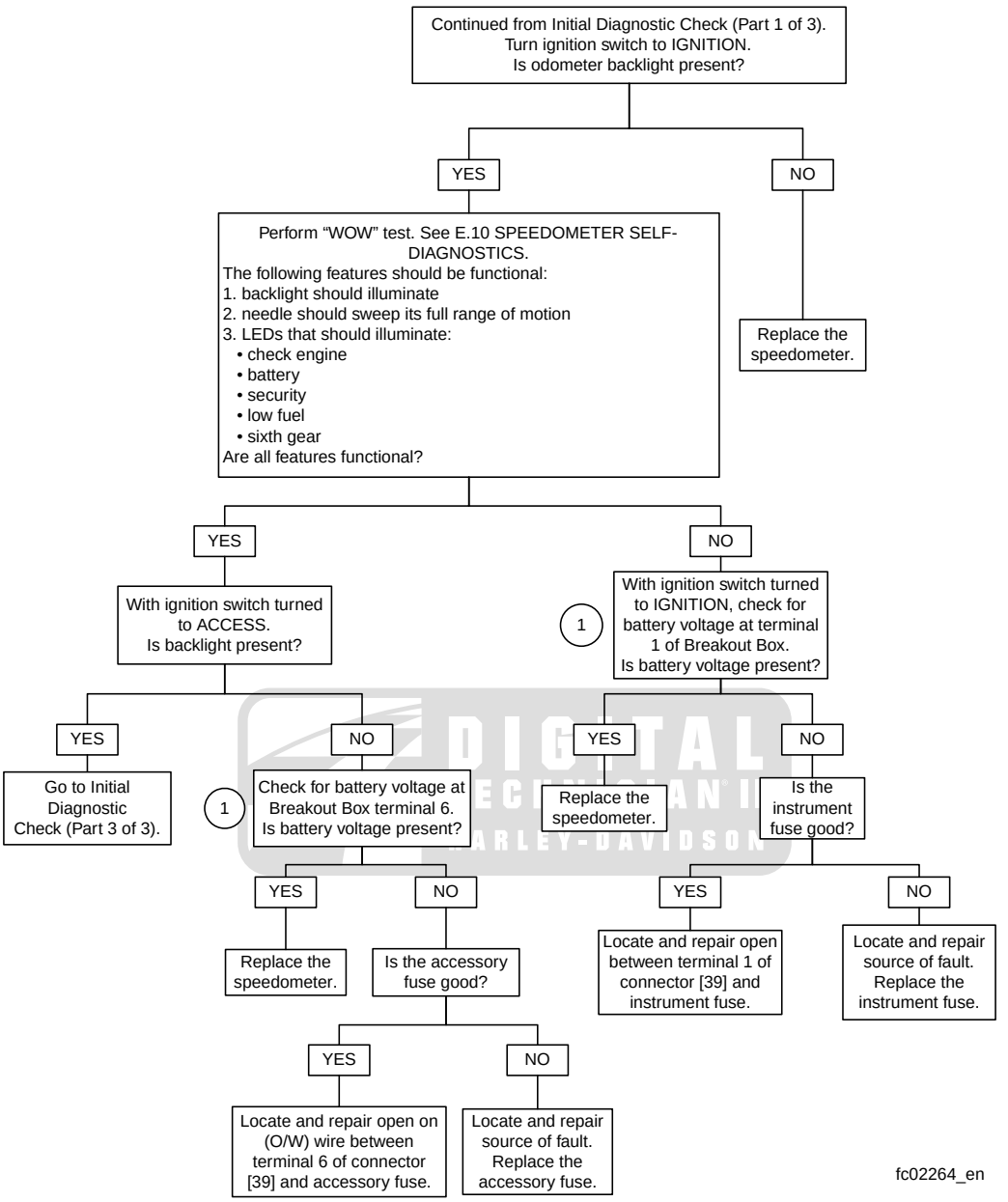
NO.	DESCRIPTION	TYPE	LOCATION
[30]	TSM/TSSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Packard	Back of speedometer (back of console)
[78]	ECM	73-place Packard	Under seat
[91]	DLC	4-place Deutsch	Under left side cover
[166]	ABS module (if equipped)	20-place Molex	Under right side cover

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

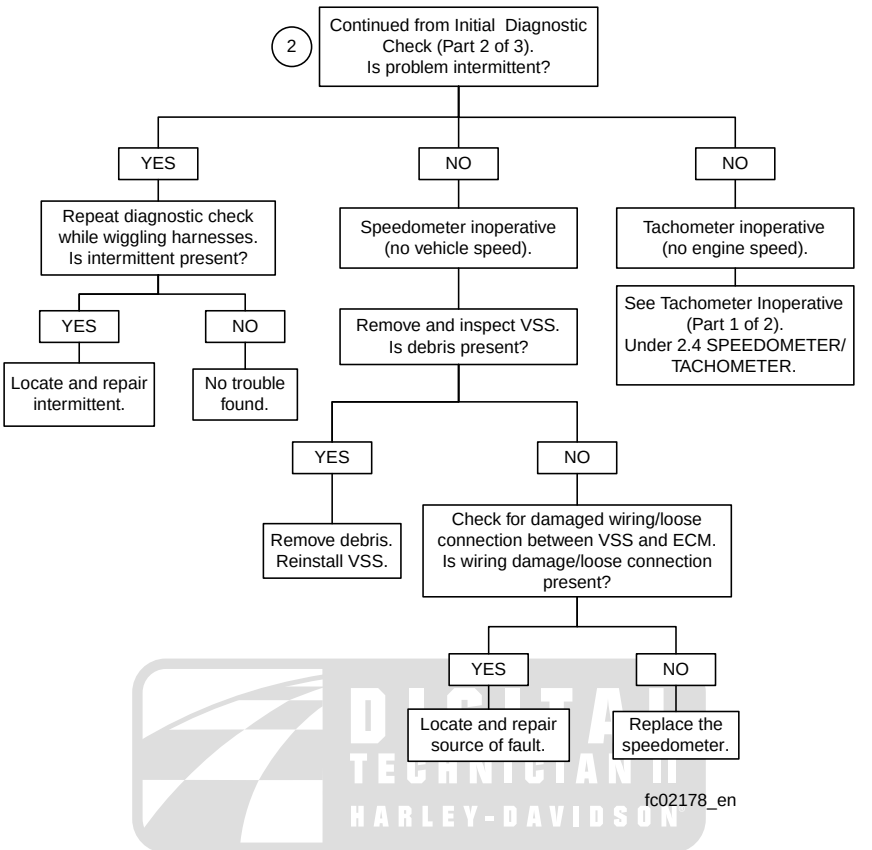
Initial Diagnostic Check (Part 1 of 3)



Initial Diagnostic Check (Part 2 of 3)



Initial Diagnostic Check (Part 3 of 3)



SPEEDOMETER SELF-DIAGNOSTICS E.10

GENERAL

The odometer is capable of displaying and clearing speedometer, tachometer, TSM/TSSM, ABS, and ECM DTCs (diagnostic mode).

DIAGNOSTICS

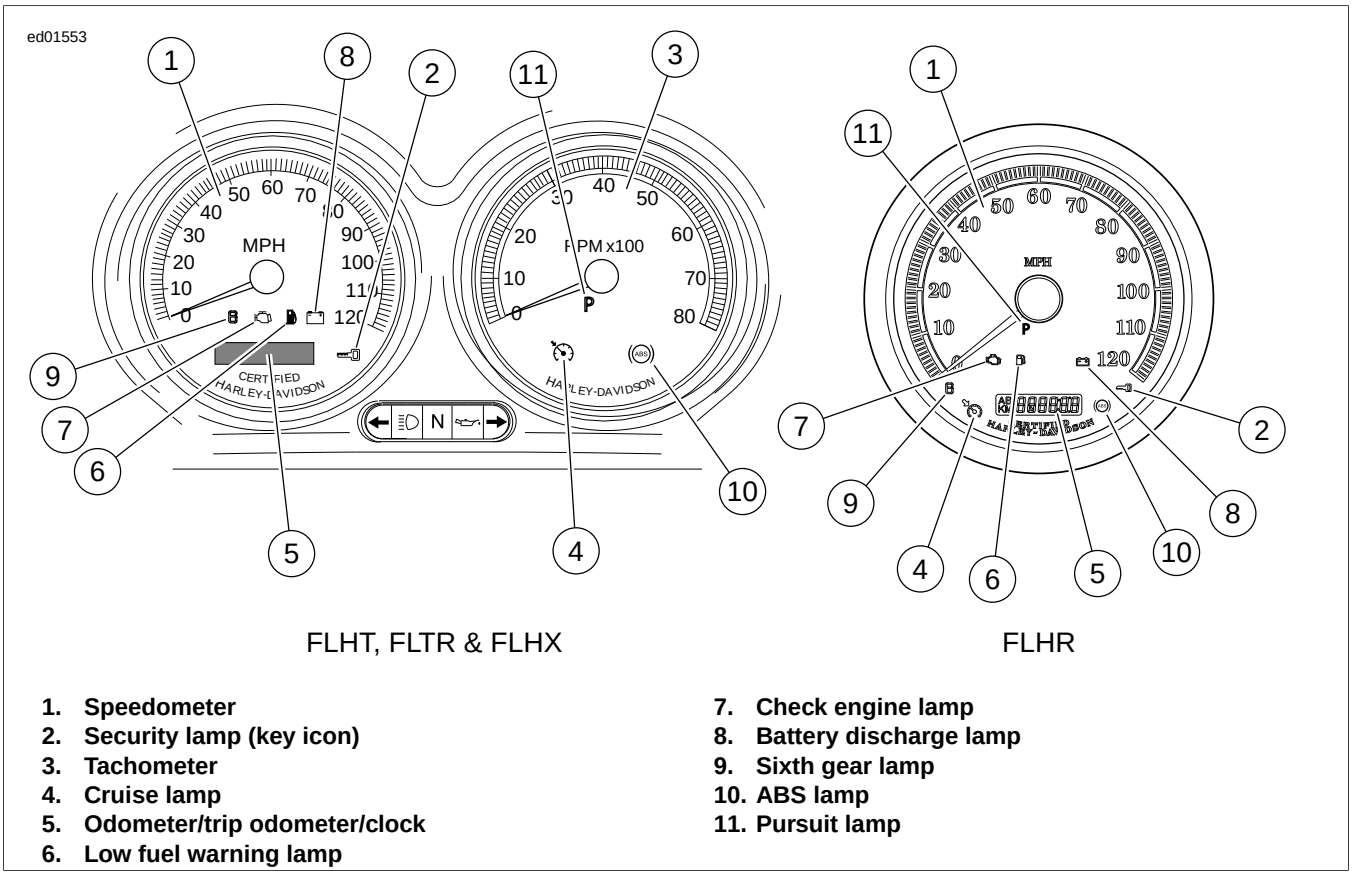
Diagnostic Tips

- For a quick check of speedometer function, perform a "WOW" test. Press and hold trip odometer reset switch then turn ignition switch on. Release trip odometer reset switch. See Figure E-10. Background lighting should illuminate, gauge needles should sweep their full range of motion, and indicator lamps (battery, security, low fuel, check engine, ABS, cruise, pursuit and sixth gear) should illuminate. All lamps should illuminate, even those not used in normal vehicle operations.
- If speedometer fails "WOW" test, check for battery, ground, ignition, trip odometer reset switch and accessory wiring to speedometer. If any feature in the speedometer is non-functional, see 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

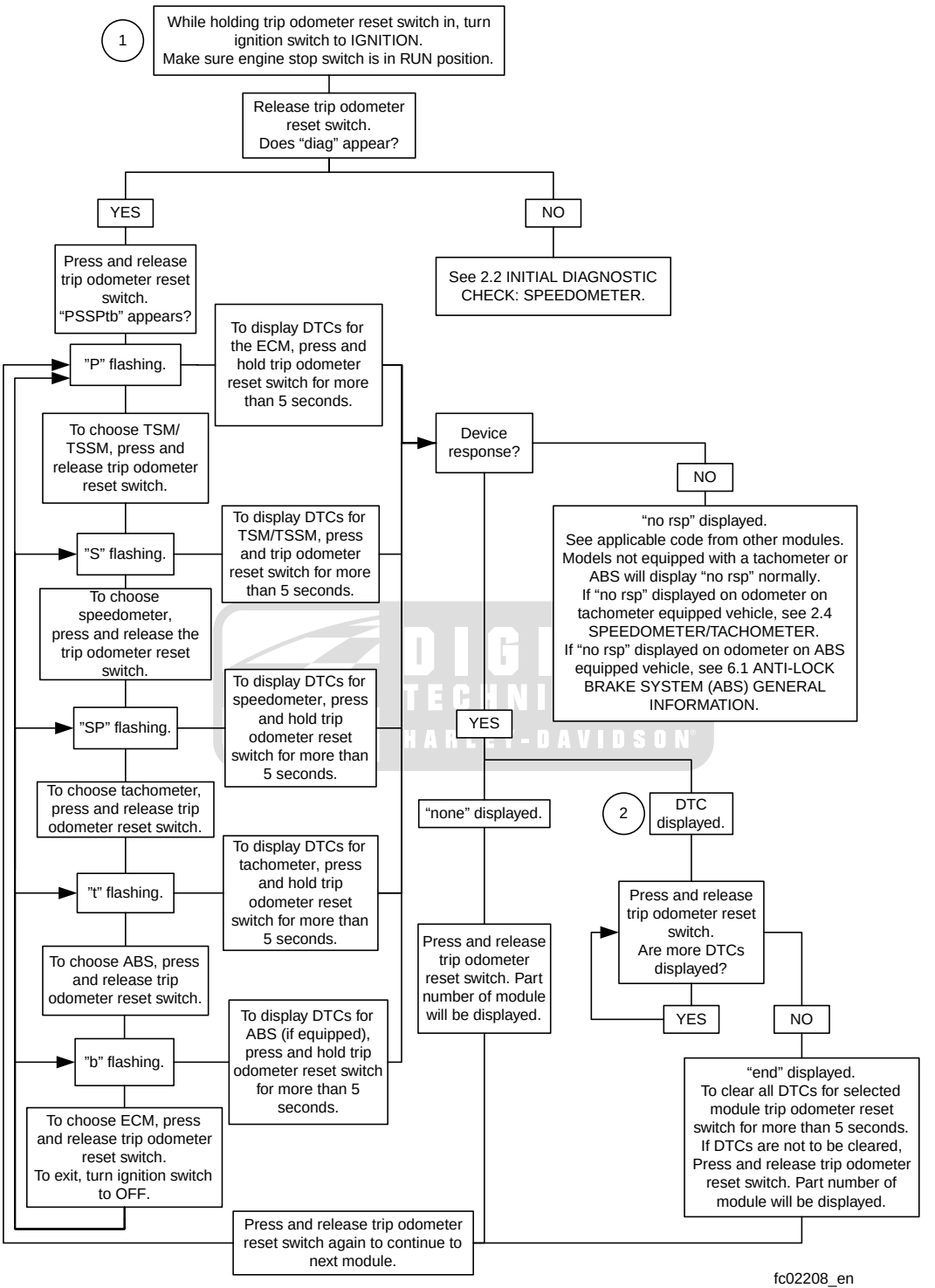
1. To exit diagnostic mode, turn ignition switch off.
2. To clear DTCs for the selected module, press the trip odometer reset switch for more than 5 seconds when a DTC is displayed. This procedure clears all DTCs for the selected module.



1. **Speedometer**
2. **Security lamp (key icon)**
3. **Tachometer**
4. **Cruise lamp**
5. **Odometer/trip odometer/clock**
6. **Low fuel warning lamp**
7. **Check engine lamp**
8. **Battery discharge lamp**
9. **Sixth gear lamp**
10. **ABS lamp**
11. **Pursuit lamp**

Figure E-10. Icons

Speedometer Self-Diagnostics



BREAKOUT BOX: TSM/TSSM E.11

GENERAL

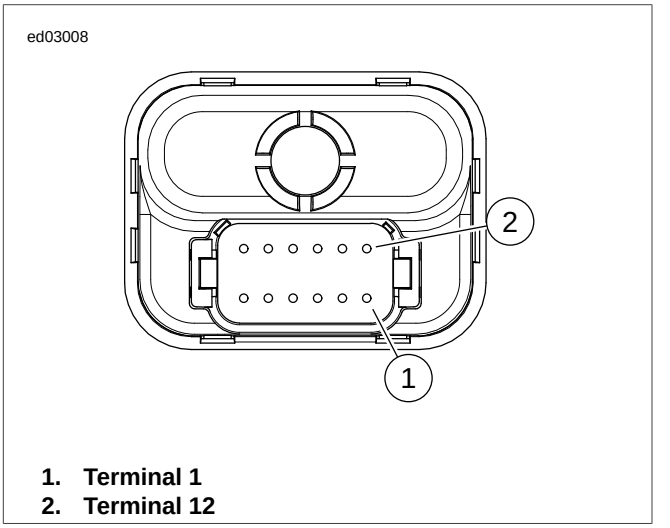
PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

The BREAKOUT BOX (Part No. HD-42682) splices into the main harness. Used in conjunction with a DVOM, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects.

INSTALLATION

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

1. Disarm security system
2. Gain access to TSM/TSSM. See the service manual.
3. See Figure E-11. Press latches on harness connector [30B].
4. Attach BREAKOUT BOX (Part No. HD-42682) to connector.
 a. Mate gray socket housing on BREAKOUT BOX (Part No. HD-42682) with TSM/TSSM connector [30A].
 b. Mate gray pin housing on BREAKOUT BOX (Part No. HD-42682) with harness connector [30B].



1. Terminal 1
2. Terminal 12

Figure E-11. TSM/TSSM Connector Pins

REMOVAL

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

1. See Figure E-11. Press latches on connector [30B].
2. Detach gray BREAKOUT BOX (Part No. HD-42682) connector from TSM/TSSM connector [30A].
3. Detach gray BREAKOUT BOX (Part No. HD-42682) connector from wire harness connector [30B].
4. Reinstall TSM/TSSM. See the service manual.
5. Install parts removed for access.

NOTE

Vehicle will not start with TSM/TSSM disconnected or incorrectly mounted.

Table E-13. TSM/TSSM Connector [30B]

TERMINAL	FUNCTION	TERMINAL	FUNCTION
1	Battery 12V	7	Right turn switch input
2	Battery 12V switched	8	Left turn switch input
3	Serial data	9	Start relay ground
4	Neutral switch input	10	Clutch switch input
5	Left turn feed output	11	Alarm signal output
6	Right turn feed output	12	Chassis ground

FAILS TO DISARM (TSSM ONLY) E.12

GENERAL

Security Equipped Vehicles Only

This section applies only to those vehicles equipped with the optional TSSM.

NOTE

Disarming function may require practice. Press the key fob button twice within 1.5 seconds to send the disarm command. The action is very similar to double-clicking a computer mouse. Light quick taps work best; very hard or very slow taps are less likely to work.

The key fob sends a radio frequency signal to activate all remote TSSM functions. The left front turn signal switch wire serves as the motorcycle's antenna. If the TSSM does not respond (no confirmation at arming/disarming system) or responds weakly (limited range, won't consistently arm/disarm or synchronize), follow the flowchart.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

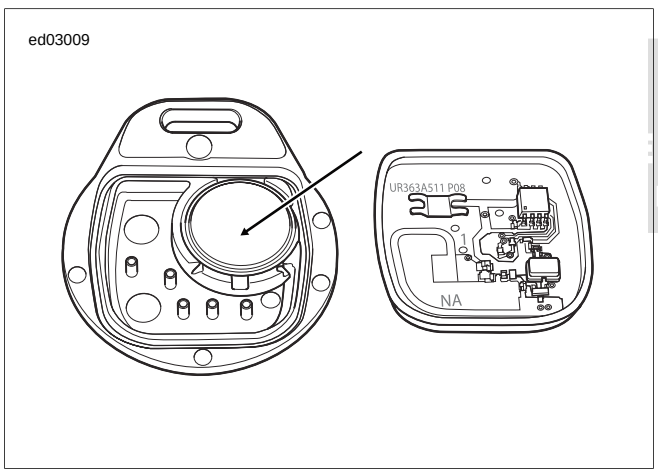


Figure E-12. Key Fob Battery: TSSM

DIAGNOSTICS

Diagnostic Tips

- Verify key fob battery voltage is at least 2.9 Volts. See E.23 TSSM MAINTENANCE.
- Interference from physical surroundings may affect RF transmission. Place fob next to left handgrip and disarm with two clicks or move motorcycle to a new location and retest.
- Check for damage to antenna wire. Does left turn signal work?

NOTE

See E.7 ARMING/DISARMING (TSSM ONLY). Use only the proper key fob for your market and TSSM package.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. After a battery disconnect, the TSSM will not enter the configuration mode on the first attempt. All attempts to assign a fob or enter the configuration mode require at least two attempts.

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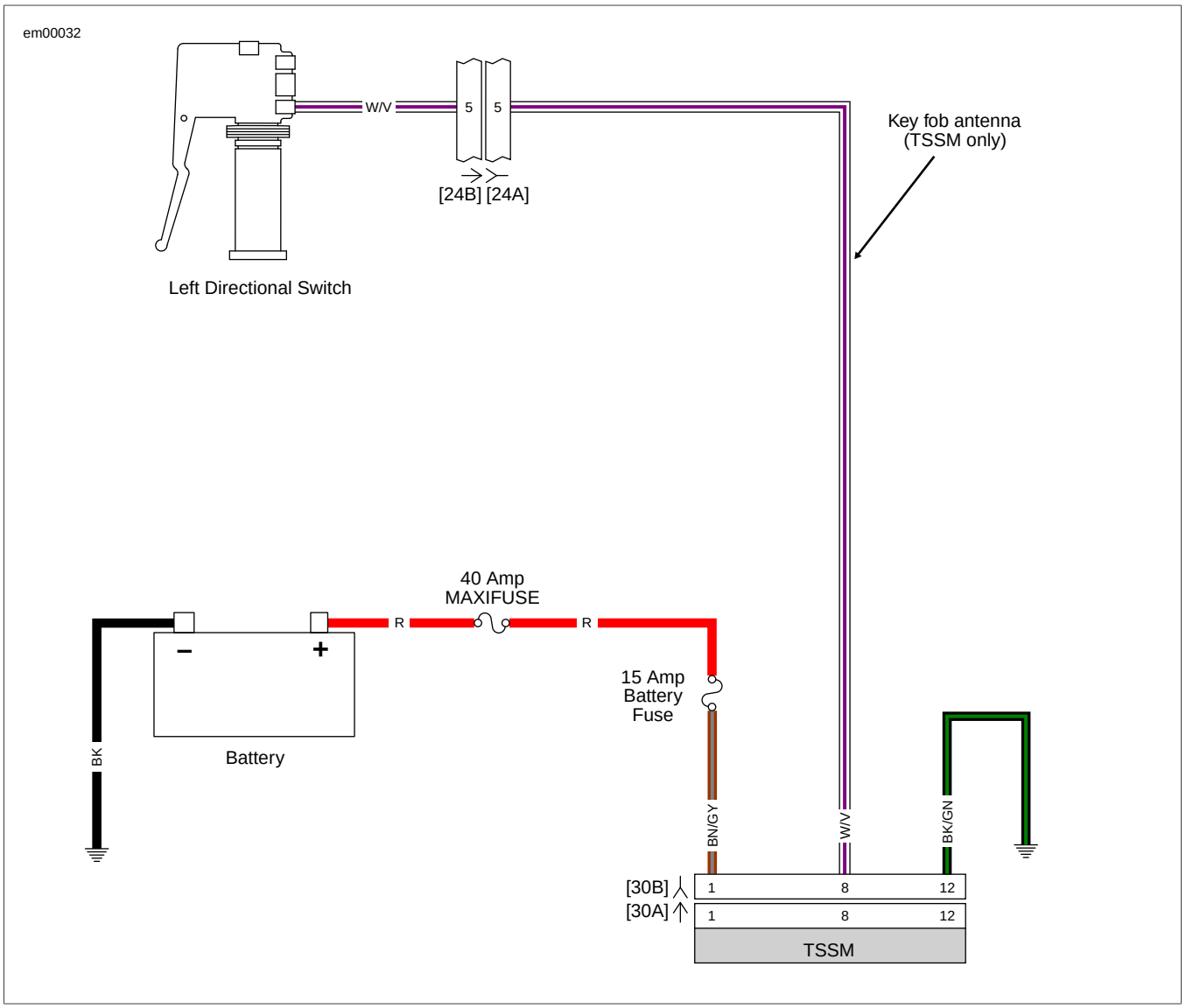
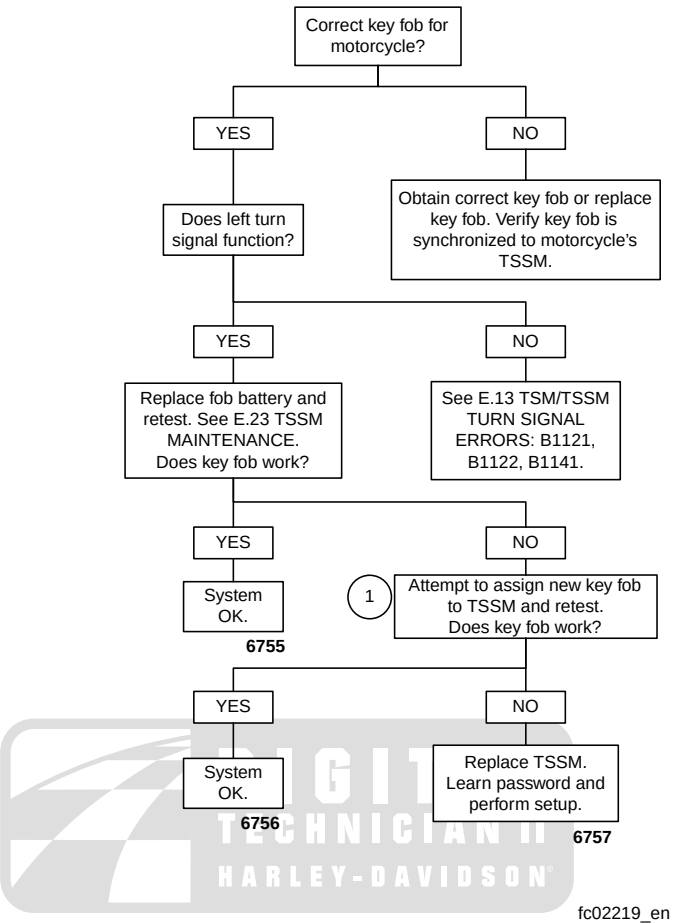


Figure E-13. Antenna Circuit

Table E-14. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[24]	Left handlebar switches	FLHR/C	8-place Molex (gray)	Inside headlamp nacelle - fork stem nut lock plate (right side)
		FLHX, FLHT/C/U	16-place Molex (gray)	Inner fairing - left fairing support brace
		FLTR	16-place Molex (gray)	Inner fairing - left fairing support brace
[30]	TSM/TSSM	All	12-place Deutsch	Under right side cover

Fails to Disarm



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TSM/TSSM TURN SIGNAL ERRORS: B1121, B1122, B1141 E.13

GENERAL

The turn signals automatically cancel either based on the speed/acceleration of the vehicle or upon turn completion. See E.4 TSM/TSSM TURN SIGNAL FUNCTIONS.

For turn signal diagnostics, refer to Table E-15.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

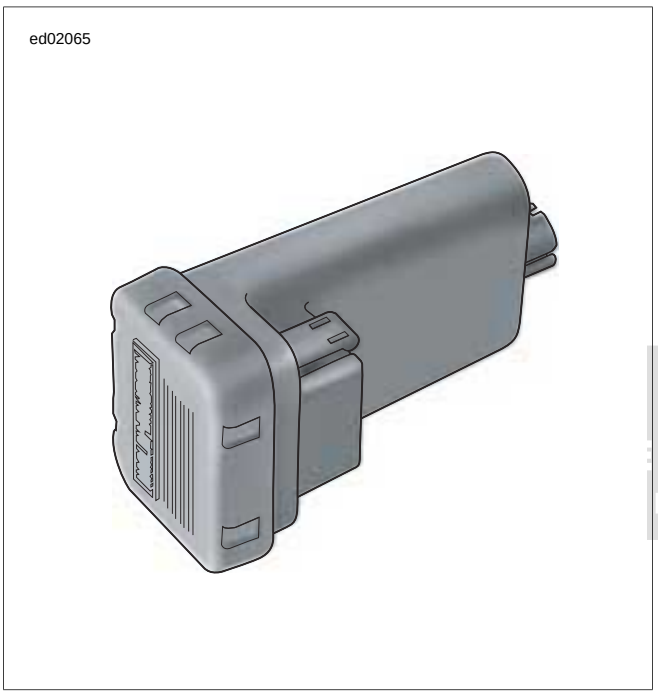
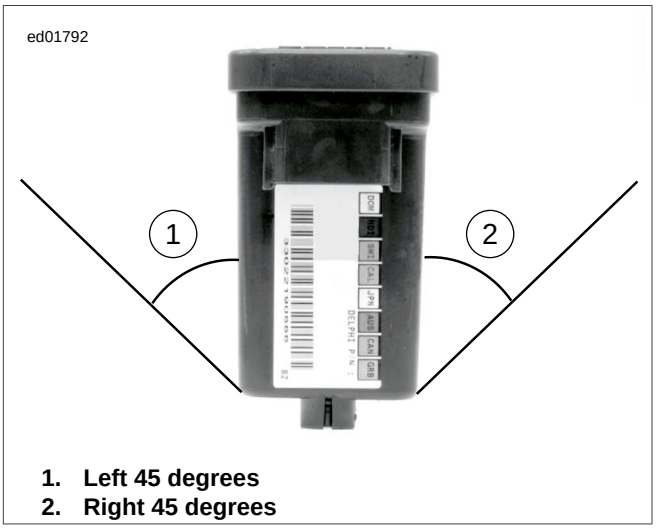


Figure E-14. TSM/TSSM



1. **Left 45 degrees**
2. **Right 45 degrees**

Figure E-15. Tilting TSM/HFSM

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX

Diagnostic Tips: All

- DTCs B1121 and B1122 illuminate the security lamp.
- DTC B1141 does not illuminate the security lamp.
- When the TSM/TSSM is in four-way flasher mode, a fault on either the left or right turn lamp output will not cause either DTC B1121 or B1122 to set. If fault occurs on both left and right outputs, then both DTC B1121 and B1122 will set.
- When the TSM/TSSM detects an over current or short to ground condition, it turns off the turn lamp outputs. The outputs are automatically reactivated once the fault is removed.

Table E-15. Turn Signal Errors: TSM/TSSM

DTC	SYMPTOM	START WITH FLOWCHART
N/A	Turn signals cancel erratically	Cancels Erratically
B1121, B1122, B1141	Turn signals will not flash, four-way flashers inoperable	DTC B1121, DTC B1122, DTC B1141, Will Not Flash, 4-Way Flashers Inoperable (Part 1 of 6)
N/A	Turn signals will not cancel upon turn completion	Will Not Cancel Upon Turn Completion
N/A	Left or right turn signals flash at double the normal rate while all bulbs are working	Flash at Double Normal Rate, All Bulbs Working

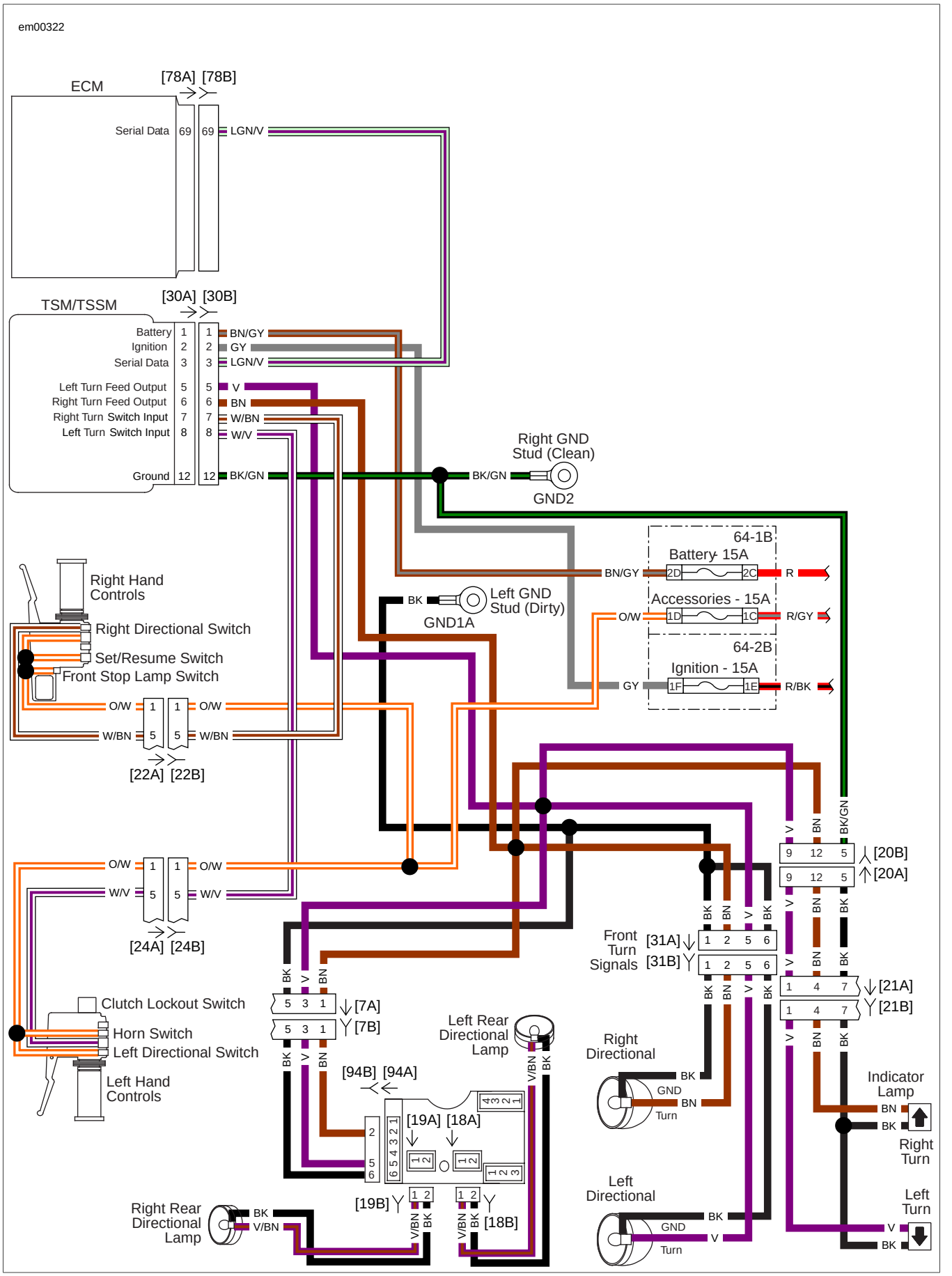


Figure E-16. Turn Signal Circuit (FLHR/C)

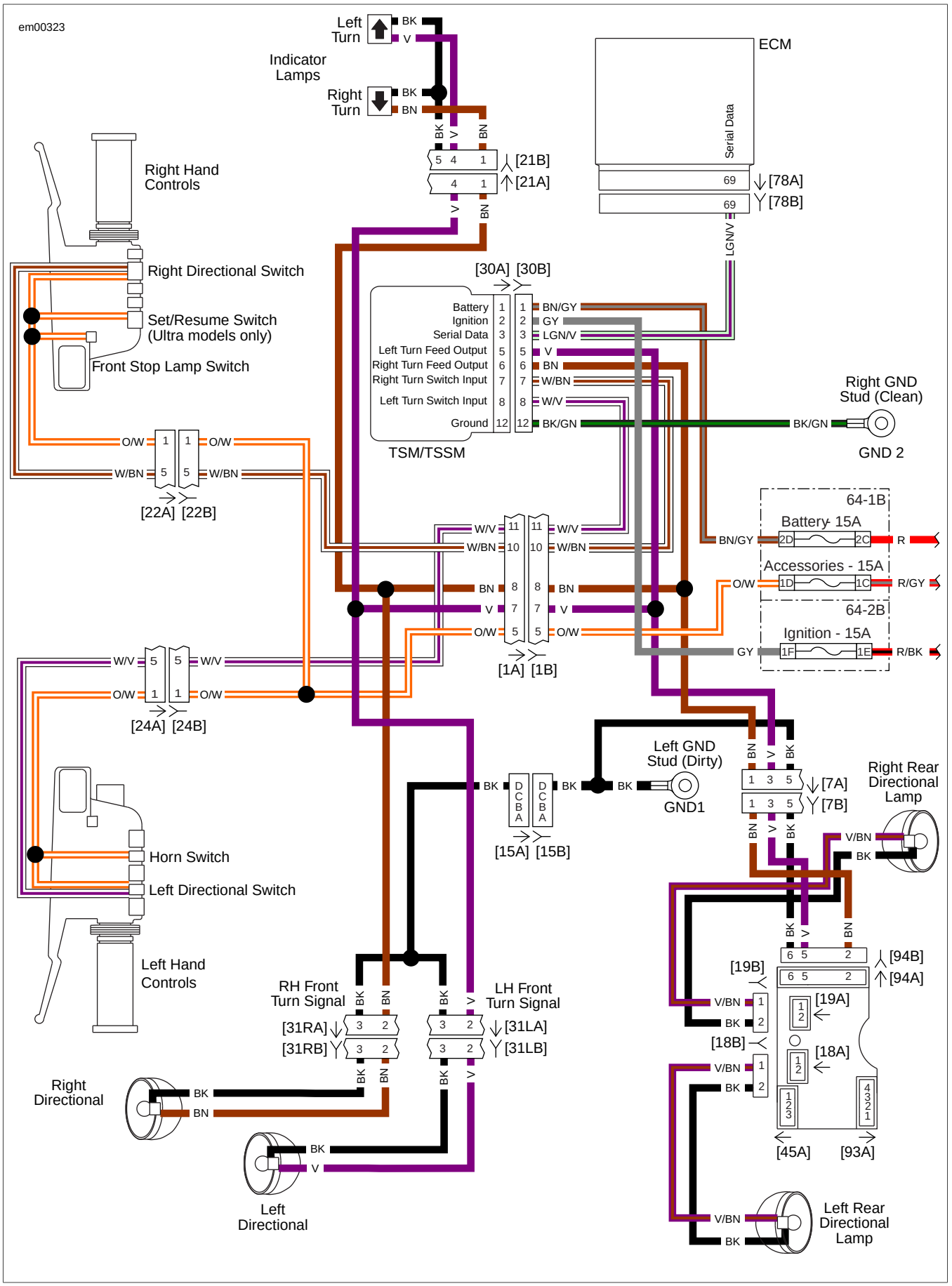


Figure E-17. Turn Signal Circuit (FLHX, FLHT/C/U, FLTR)

Table E-16. Wire Harness Connectors

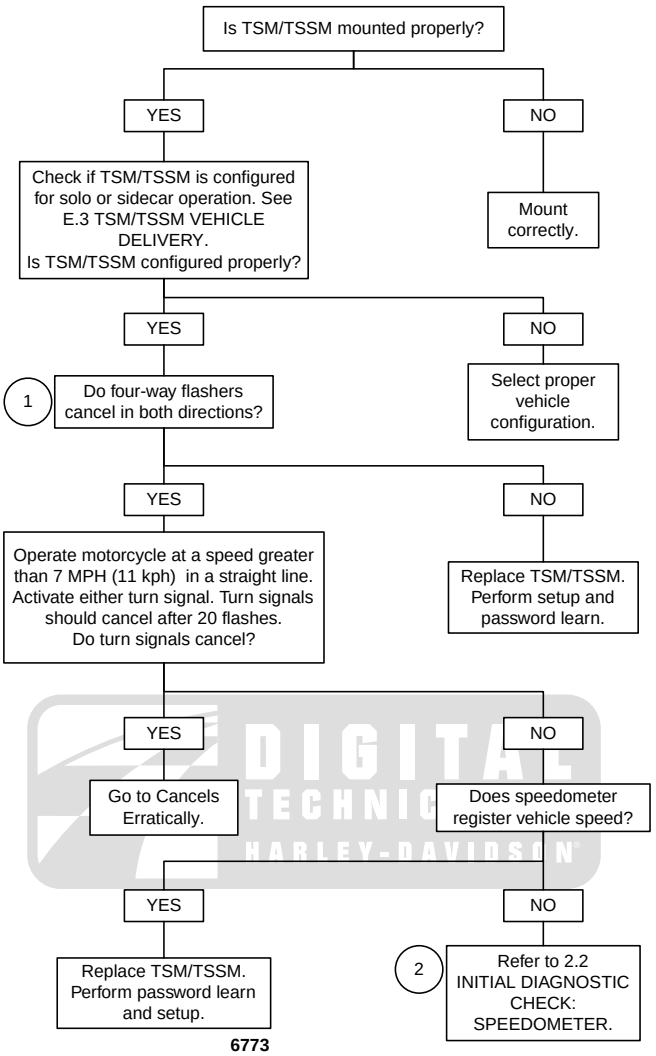
NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHT/C/U	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side below radio
[7]	Rear fender lights harness	All	8-place Multilock	Top of rear fender (under seat)
[15]	Main to interconnect harness	FLHT/C/U	4-place Packard	Inner fairing - right fairing bracket
		FLTR	4-place Packard	Inner fairing - below radio (right side)
[18]	Left rear turn signal	All	2-place Multilock	Circuit board under tail lamp assembly
[19]	Right rear turn signal	All	2-place Multilock	Circuit board under tail lamp assembly
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[21]	Indicator lamps	FLHR/C	8-place Deutsch	Under console
		FLHT/C/U	10-place Multilock	Inner fairing - above radio
[22]	Right handlebar switches	FLHR/C	6-place Molex (Black)	Inside headlamp nacelle - fork stem nut lock plate (right side)
		FLHT/C/U	12-place Molex (Black)	Inner fairing - right fairing support brace
[24]	Left handlebar switches	FLHR/C	8-place Molex (Gray)	Inside headlamp nacelle - fork stem nut lock plate (left side)
		FLHT/C/U	16-place Molex (Gray)	Inner fairing left fairing support brace
[30]	TSM/TSSM	All	12-place Deutsch	Under right side cover
[31]	Left/right front turn signal/auxiliary lamp	FLHR/C	6-place Multilock	Inside headlamp nacelle - fork stem nut lock plate (left side)
		FLHT/C/U	4-place Multilock	Inner fairing left/right fairing support brace
[33]	Ignition Switch	FLHR/C	3-place Packard	Under console
		FLHT/C/U	3-place Packard	Bottom of ignition switch
[78]	ECM	All	73-place Delphi	Under seat
[94]	Rear fender lights harness	All	6-place Multilock	Circuit board under tail lamp assembly
[GND1] [GND1A] [GND2]	Harness grounds	All	Ring terminals	Under seat

Diagnostic Notes: All Turn Signal Flowcharts

Each reference number below correlates to a circled number on the flowchart(s).

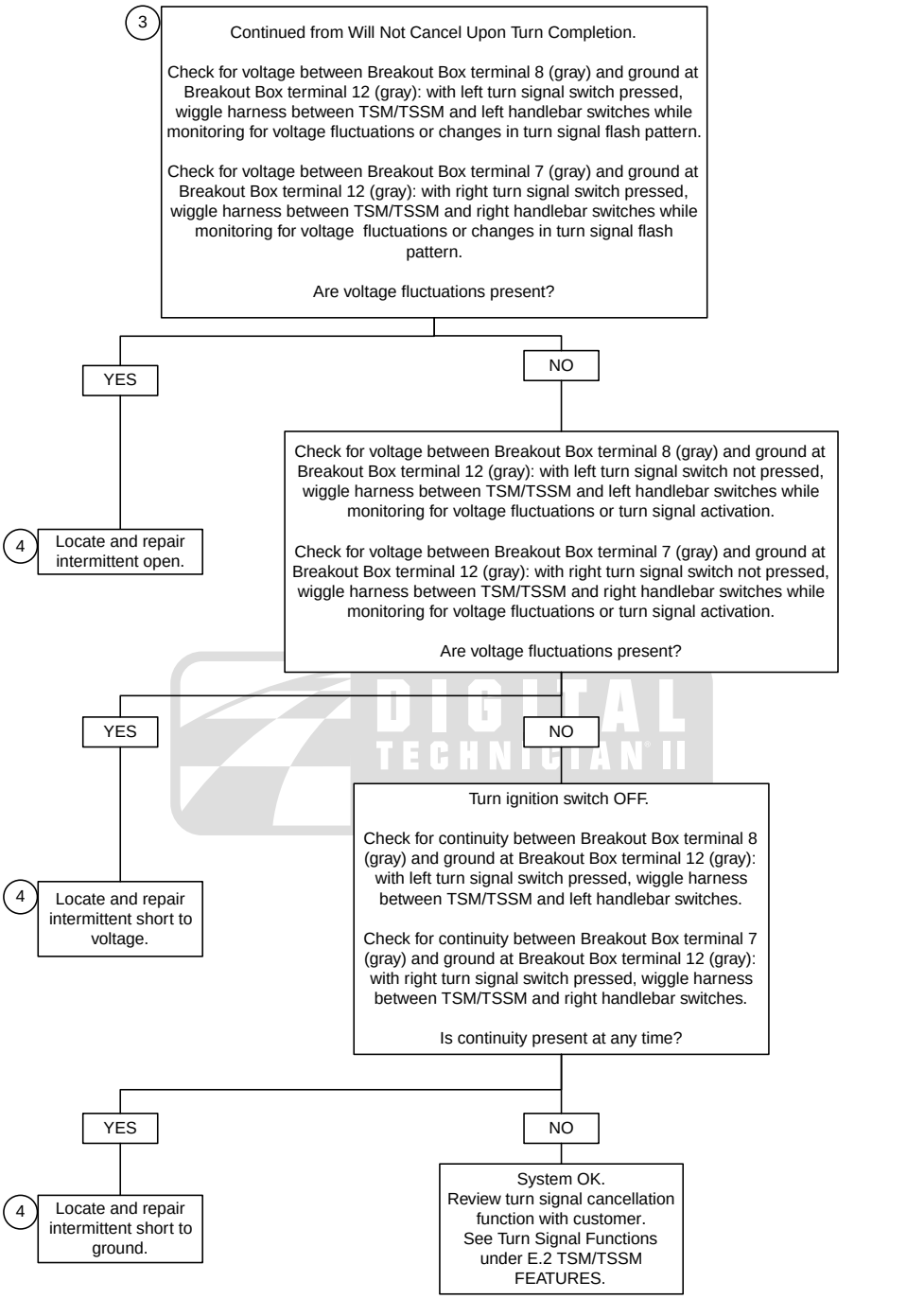
1. Gain access to vehicle's TSM/TSSM:
 a. See Figure E-15. Position TSM/TSSM in same orientation it is mounted on vehicle. Turn the ignition switch to IGNITION. Turn on four-way flashers by pressing both left and right turn signal switches simultaneously. Turn ignition switch off; four-way flashers should continue to flash.
 b. Tilt module greater than 45 degrees to the left.
 c. Repeat step a.
 d. Tilt module greater than 45 degrees to the right.
2. To enable diagnostic mode, see E.10 SPEEDOMETER SELF-DIAGNOSTICS.
3. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/TSSM connector [30A] and wiring harness connector [30B]. See E.11 BREAKOUT BOX: TSM/TSSM.
4. Closely inspect handlebar controls for pinched wiring.
5. Connect gray HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) adapters and patch cords to connector [22] (right) or connector [24] (left).

Will Not Cancel Upon Turn Completion



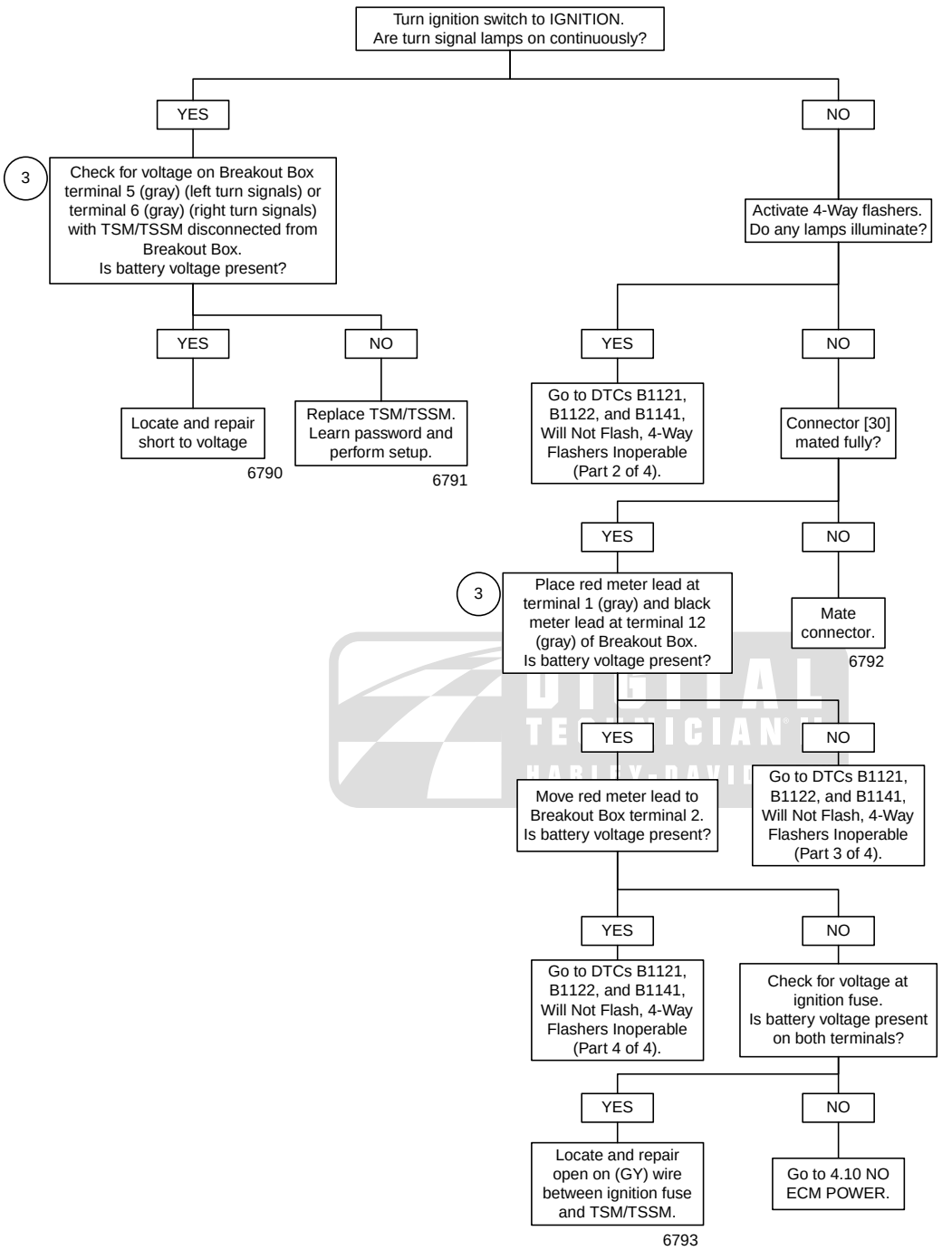
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Cancels Erratically



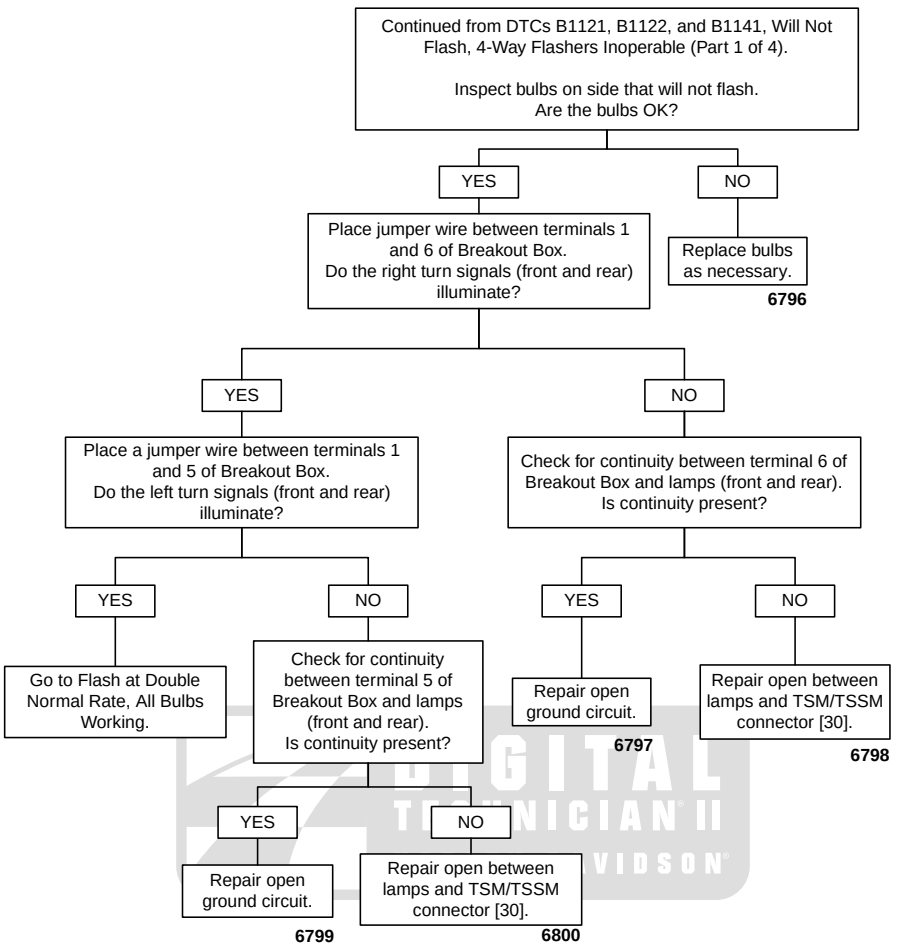
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DTCs B1121, B1122, and B1141, Will Not Flash, 4-Way Flashers Inoperable (Part 1 of 4)



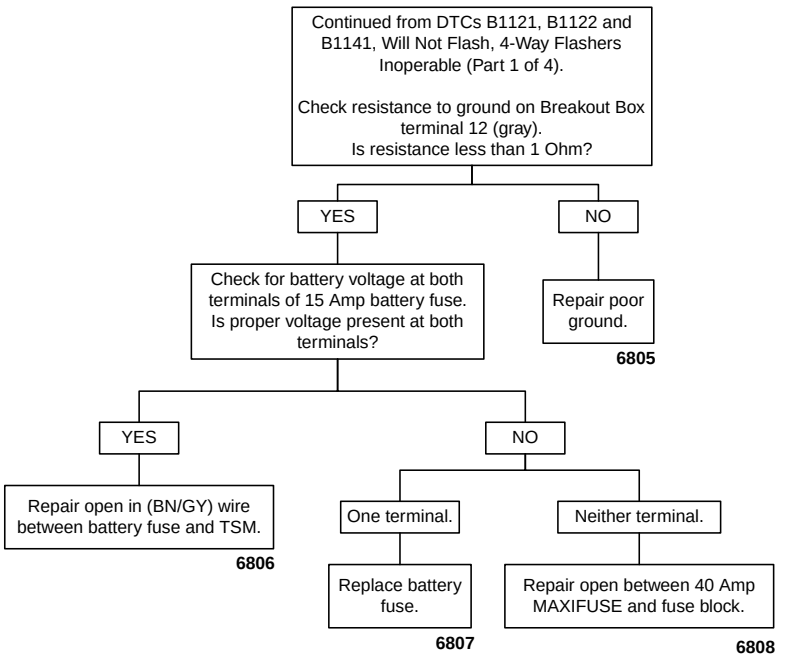
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DTCs B1121, B1122, and B1141, Will Not Flash, 4-Way Flashers Inoperable (Part 2 of 4)



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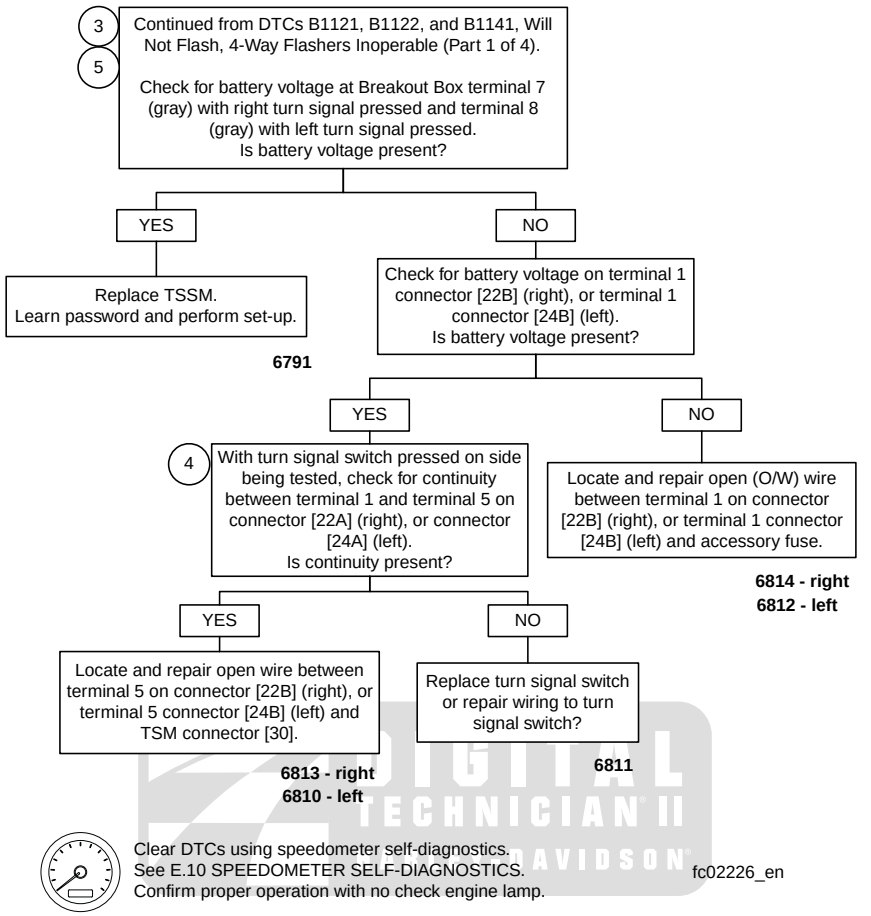
DTCs B1121, B1122, and B1141, Will Not Flash, 4-Way Flashers Inoperable (Part 3 of 4)



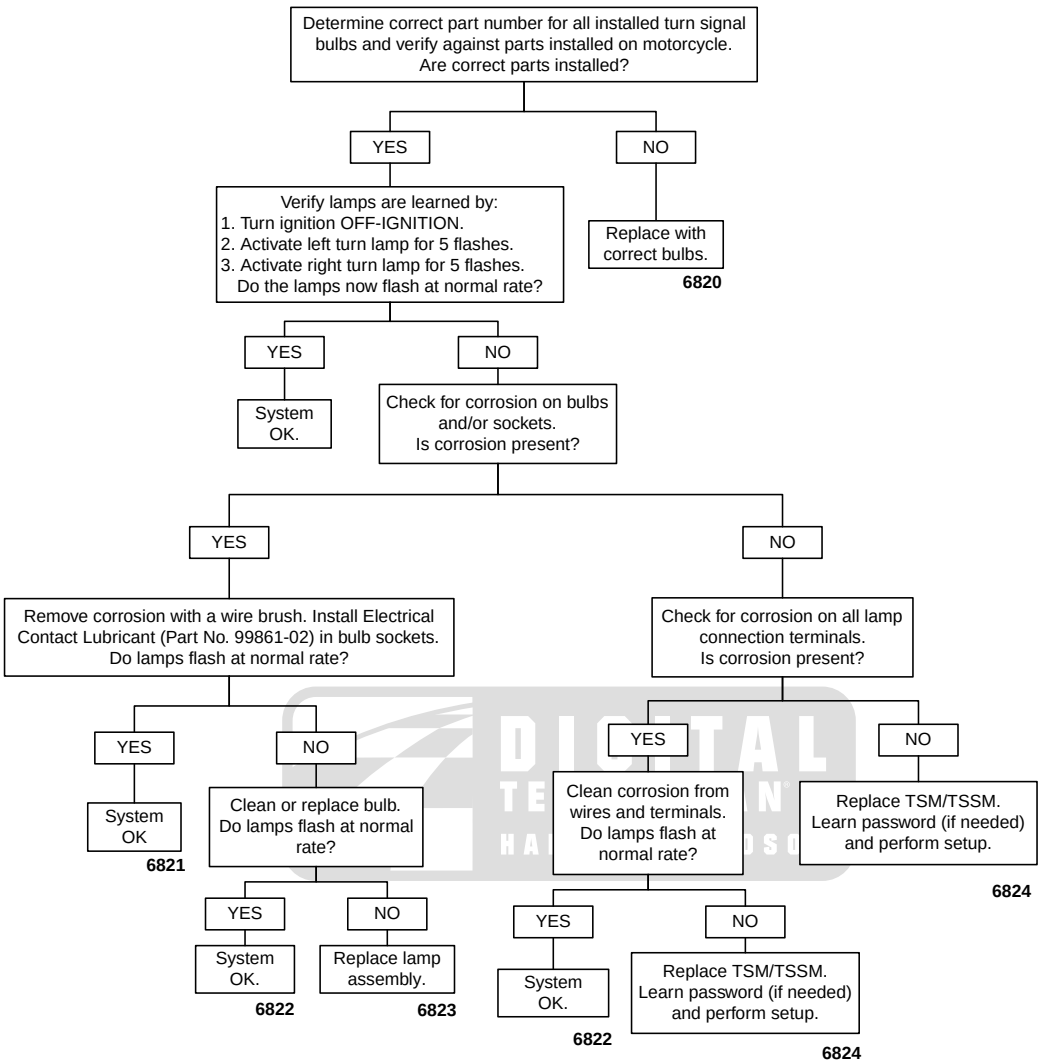
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DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTCs B1121, B1122, and B1141, Will Not Flash, 4-Way Flashers Inoperable (Part 4 of 4)



Flash at Double Normal Rate, All Bulbs Working



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DTC B0563 E.14

GENERAL

Battery Voltage High

The TSM/TSSM continually checks the battery voltage during IGN/OFF and IGN/RUN power modes. If the voltage exceeds 16.0 Volts for more than 5.0 ± 0.5 seconds, the TSM/TSSM sets DTC B0563.

DIAGNOSTICS

Diagnostic Tips

- This DTC may set when the vehicle is placed on a battery charger, on fast charge, for a long period of time.
- The TSSM does not illuminate the security lamp when this DTC is set.

Diagnostic Notes

Problem may be faulty voltage regulator. See 1.7 CHARGING SYSTEM tests to correct.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1131, B1132 E.15

GENERAL

NOTE

This section applies only to those vehicles equipped with the optional security system.

Alarm Output Low (DTC B1131) or Alarm Output High (DTC B1132)

See Figure E-18. An alarm cycle is activated when the TSSM is connected, the siren has been armed by the TSSM and a security event occurs. See E.6 SECURITY SYSTEM FUNCTIONS (TSSM ONLY). Under normal armed operation, the siren input (terminal 2) is driven low by the TSSM to trigger the audible alarm. When the siren input is driven high by the TSSM the audible alarm stops.

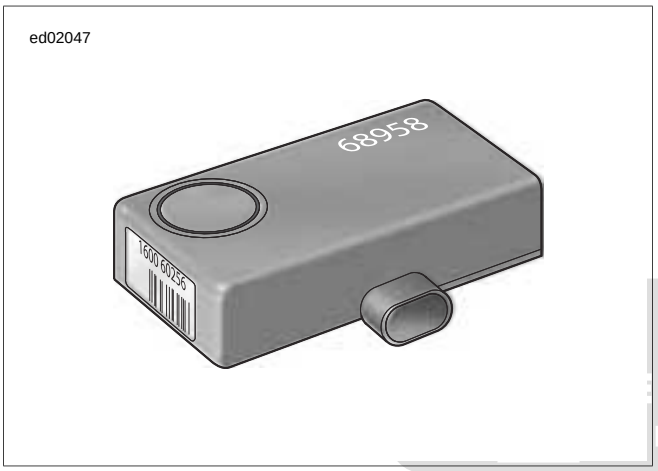


Figure E-18. Security Siren

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX

Diagnostic Tips

- If the siren is armed and the internal siren battery is dead, shorted, disconnected, or has been charging for a period longer than 24 hours, the siren responds with three chirps on arming instead of two.
- The internal siren battery may not charge if the motorcycle's battery is less than 12.5 Volts.
- If the siren does not chirp two or three times on a valid arming command from the TSSM, the siren is either not connected, not working, or the siren wiring was opened or shorted while the siren was disarmed.
- If the siren enters the self-driven mode where it is powered from the siren internal 9-Volt battery, the turn-signal lamps will not alternately flash. If the TSSM activates the siren, the turn-signal lamps will flash. If the siren has been armed and a security event occurs, and the siren is in self-driven mode, the siren alarms for 20-30 seconds and then turn off for 5-10 seconds. This alarm cycle will be repeated ten times if the siren is in the self-driven mode.
- If the siren does not stop alarming after it has been armed, then either the TSSM output or siren input may be shorted to ground, or the siren vehicle battery connection is open or shorted to ground, or the siren vehicle ground connection is open, or a security event has occurred. See E.6 SECURITY SYSTEM FUNCTIONS (TSSM ONLY) for a description of alarm functions.

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Use BREAKOUT BOX (Part No. HD-42682) and HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord. See E.11 BREAKOUT BOX: TSM/TSSM.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray socket probe and patch cord.
3. Having the correct multimeter Ohm scale is important for this test. Some meters may read infinity for high Ohm values. If this is the case, check your Ohm scale and retest.

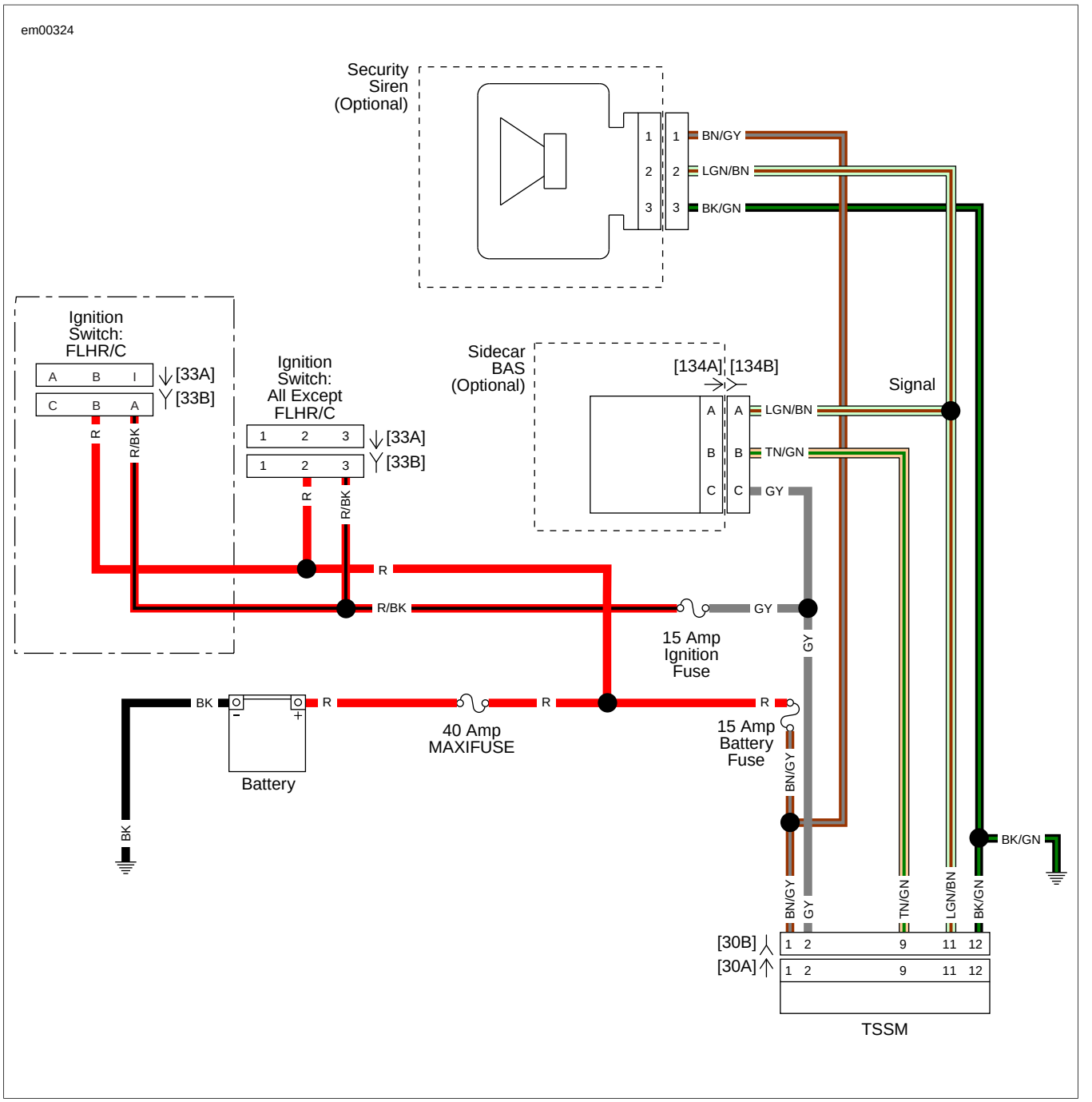
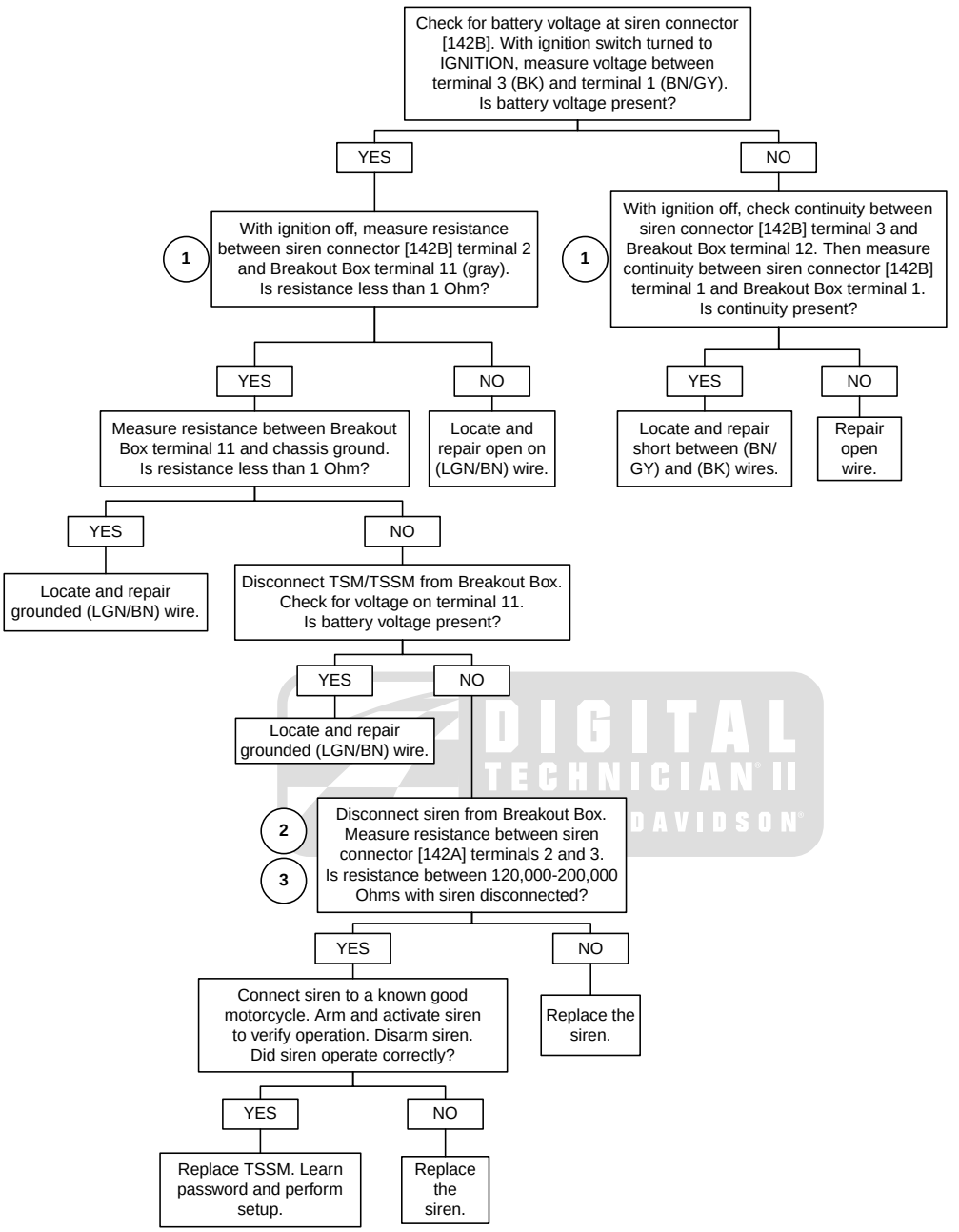


Figure E-19. Siren Circuit

Table E-17. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[30]	TSSM	All	12-place Deutsch	Under right side cover
[33]	Ignition switch	FLHR/C/S	3-place Packard	Under console
		FLHT/C/U	3-place Packard	Bottom of ignition switch
[134]	Sidecar BAS	All	3-place Packard	Under right side cover
[142]	Siren	All	3-place Delphi	Under left side cover

DTCs B1131 and B1132



Clear DTCs using speedometer self-diagnostics. See E.10 SPEEDOMETER SELF-DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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DTC B1134 E.16

GENERAL

Starter Output High

With the TSM/TSSM disarmed, ignition switch on, engine stop switch set to RUN and transmission in neutral of clutch lever pulled in, the start relay is grounded. Battery voltage is applied to the start relay and coil which are grounded through the TSM/TSSM. This DTC sets when that ground is not established through the TSM/TSSM.

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) to wire harness connector [30] leaving TSM/TSSM disconnected. See E.11 BREAKOUT BOX: TSM/TSSM.

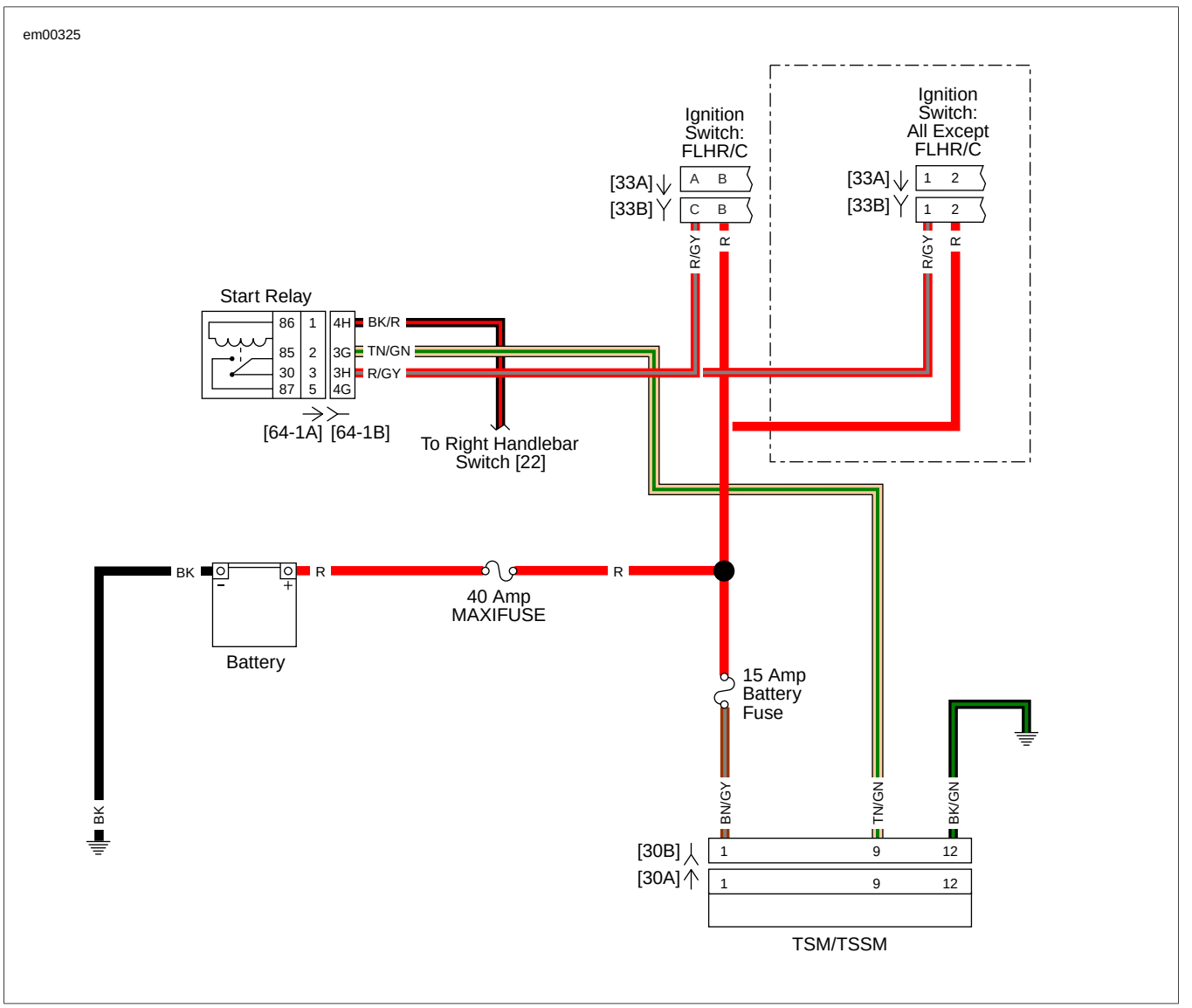


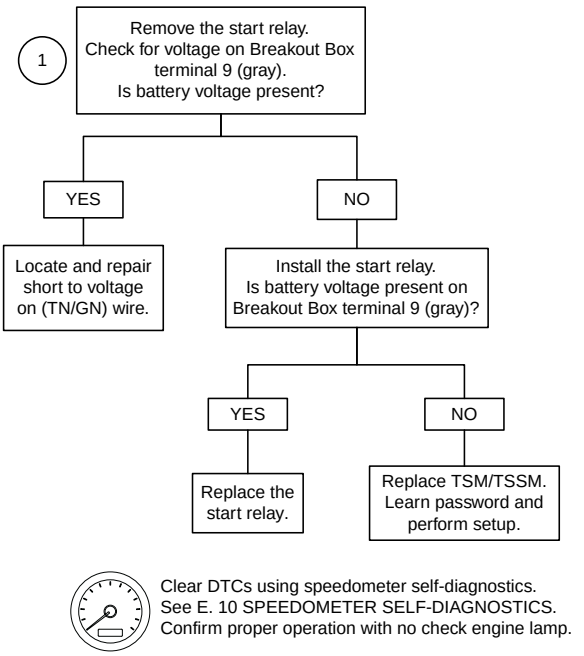
Figure E-20. Starter/TSSM Circuit

Table E-18. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[30]	TSSM	All	12-place Deutsch	Under right side cover
[33]	Ignition switch	FLHR/C/S	3-place Packard	Under console
		FLHT/C/U	3-place Packard	Bottom of ignition switch
[119]	Start relay	All	Fuse Block	Fuse block (under left side cover)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1134



DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1135 E.17

GENERAL

Accelerometer Fault: B1135

DTC B1135 indicates a failure which requires replacement of the TSM/TSSM.

NOTE

When DTC B1135 is set, the tip-over engine shutdown, TSSM tamper alarm and bank angle sensors are disabled. The security lamp also illuminates when this code is set.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1151, B1152, B1153 E.18

GENERAL

Sidecar Bank Angle Sensor (BAS)

These DTCs are set when a TSM/TSSM is configured for sidecar use and a fault is detected with the sidecar BAS.

Table E-19. Code Description

DTC	DESCRIPTION
B1153	Sidecar BAS high
B1151	Sidecar BAS short to ground
B1152	Sidecar BAS short to battery

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-48650	DIGITAL TECHNICIAN II

Diagnostic Tips

- The smart siren cannot be disarmed when the ignition switch is turned to IGNITION and a BAS is installed. If the ignition switch triggers the security alarm, turn off the switch to disarm the siren.
- Use DIGITAL TECHNICIAN II (Part No. HD-48650) to verify sidecar learn.
- Verify no other circuits are tied to terminal 11 of the TSM/TSSM.
- If a sidecar is installed without the BAS kit, the TSM/TSSM continues to operate in solo mode on a sidecar motorcycle.
- If the BAS is removed without disabling sidecar learning, the TSM/TSSM sets a DTC until sidecar learning is disabled using DIGITAL TECHNICIAN II (Part No. HD-48650), or the bank angle sensor is reinstalled.
- The software is designed to prevent the TSM/TSSM from switching to sidecar mode unless the entire system is operating properly (no DTCs set).
- The BAS cannot be detected when the security function is in the alarm mode (lights flashing, siren sounding).
- A sidecar tip-over event cannot be detected when the security function is in the alarm mode (lights flashing, siren sounding).
- A short to ground fault cannot be detected when the security function is in the alarm mode (lights flashing, siren sounding).
- A short to battery fault cannot be detected **unless** the security function is in the alarm mode (lights flashing, siren sounding).
- An out-of-range fault cannot be detected when the security function is in the alarm mode (lights flashing, siren sounding).

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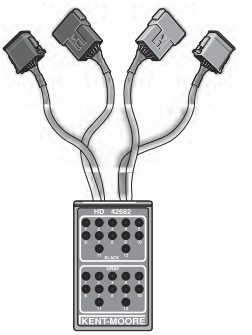


Figure E-21. Breakout Box (Part No. HD-42682)

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Figure E-22. Harness Connector Test Kit (Part No. HD-41404-B)

Diagnostic Notes

See Figure E-21 and Figure E-22. Each reference number below correlates to a circled number on the flowchart(s).

1. Use BREAKOUT BOX (Part No. HD-42682) and HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord. 3.12 BREAKOUT BOX: TSM/HFSM
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord.

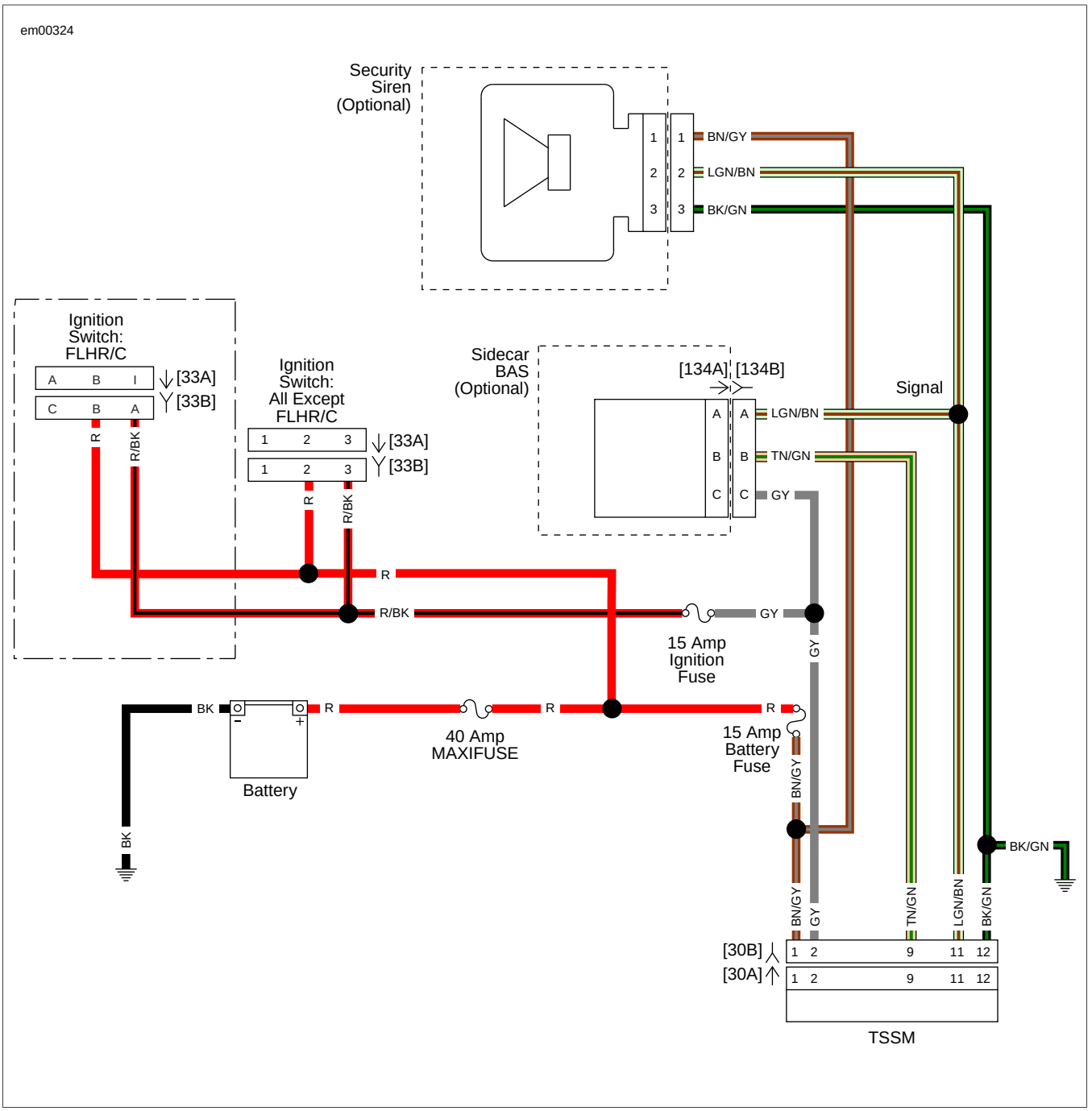
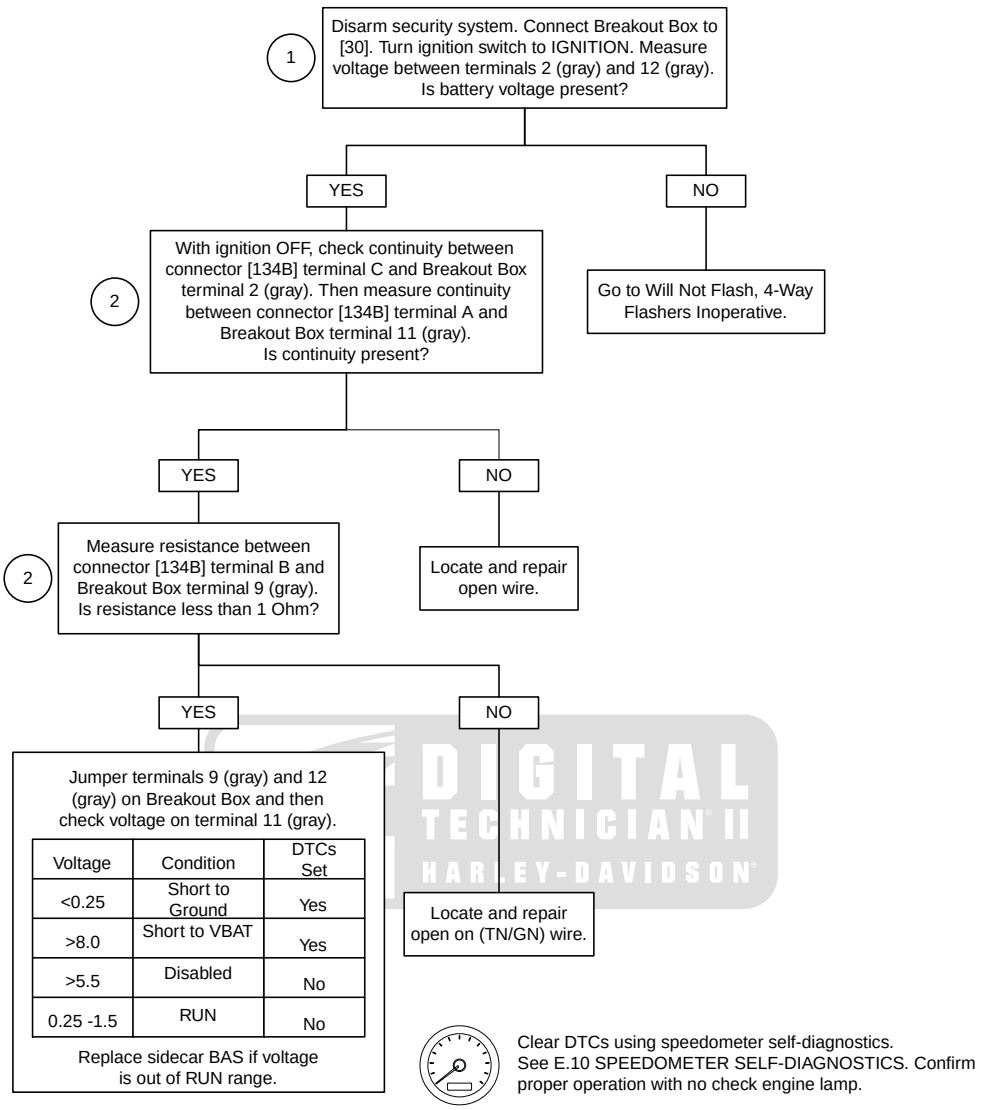


Figure E-23. Siren Circuit

Table E-20. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[30]	TSM/TSSM	All	12-place Deutsch	Under right side cover
[33]	Ignition switch	FLHR/C/S	3-place Packard	Under console
		FLHT/C/U	3-place Packard	Bottom of ignition switch
[134]	Sidecar BAS	All	3-place Packard	Under right side cover
[142]	Siren	All	3-place Packard	Under left side cover

DTCs B1151, B1152, and B1153



DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1154, B1155 E.19

GENERAL

DTCs B1154 and B1155 may occur if the motorcycle is ridden with the clutch disengaged (pulled in) at speeds greater than 16 km/h (10 mph) for more than 60 seconds (as in coasting down a long mountain road).

DIAGNOSTIC NOTES

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) to TSSM. See E.11 BREAKOUT BOX: TSM/TSSM.
2. If DTC is current (lamp) on continuously, clear codes return during operation), replace HFSM. If DTC is historic, check for intermittents.
3. A reading of several hundred Ohms is normal due to the neutral indicator lamp (LED).

Table E-21. Clutch/Neutral Switch DTCs

DTC	DESCRIPTION	GO TO
B1154	Clutch switch short-to-ground	Clutch Switch Short-to-Ground: DTC B1154
B1155	Neutral switch short-to-ground	Neutral Switch Short-to-Ground: DTC B1155

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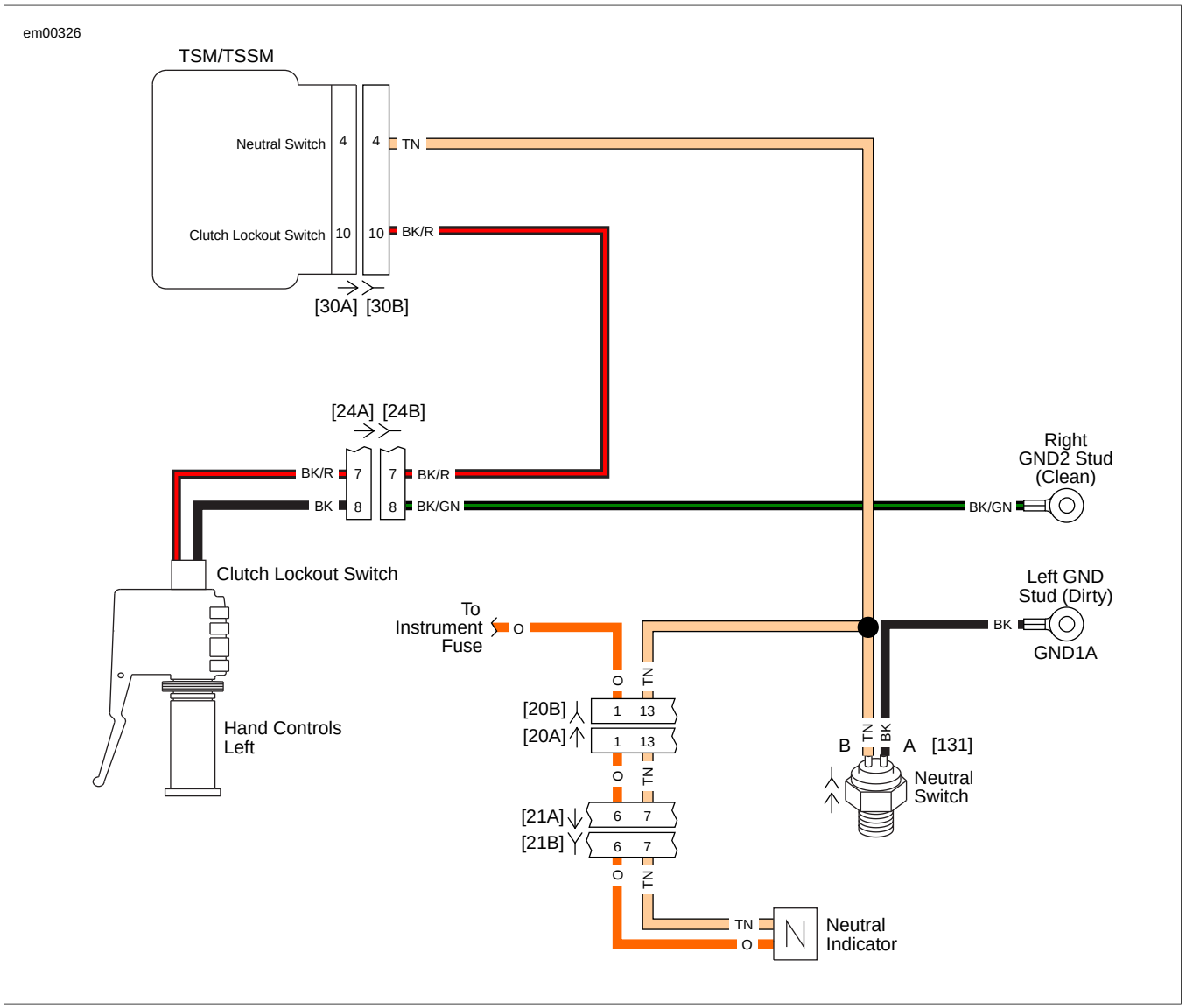


Figure E-24. Clutch and Neutral Interlock Circuits (FLHR/C)

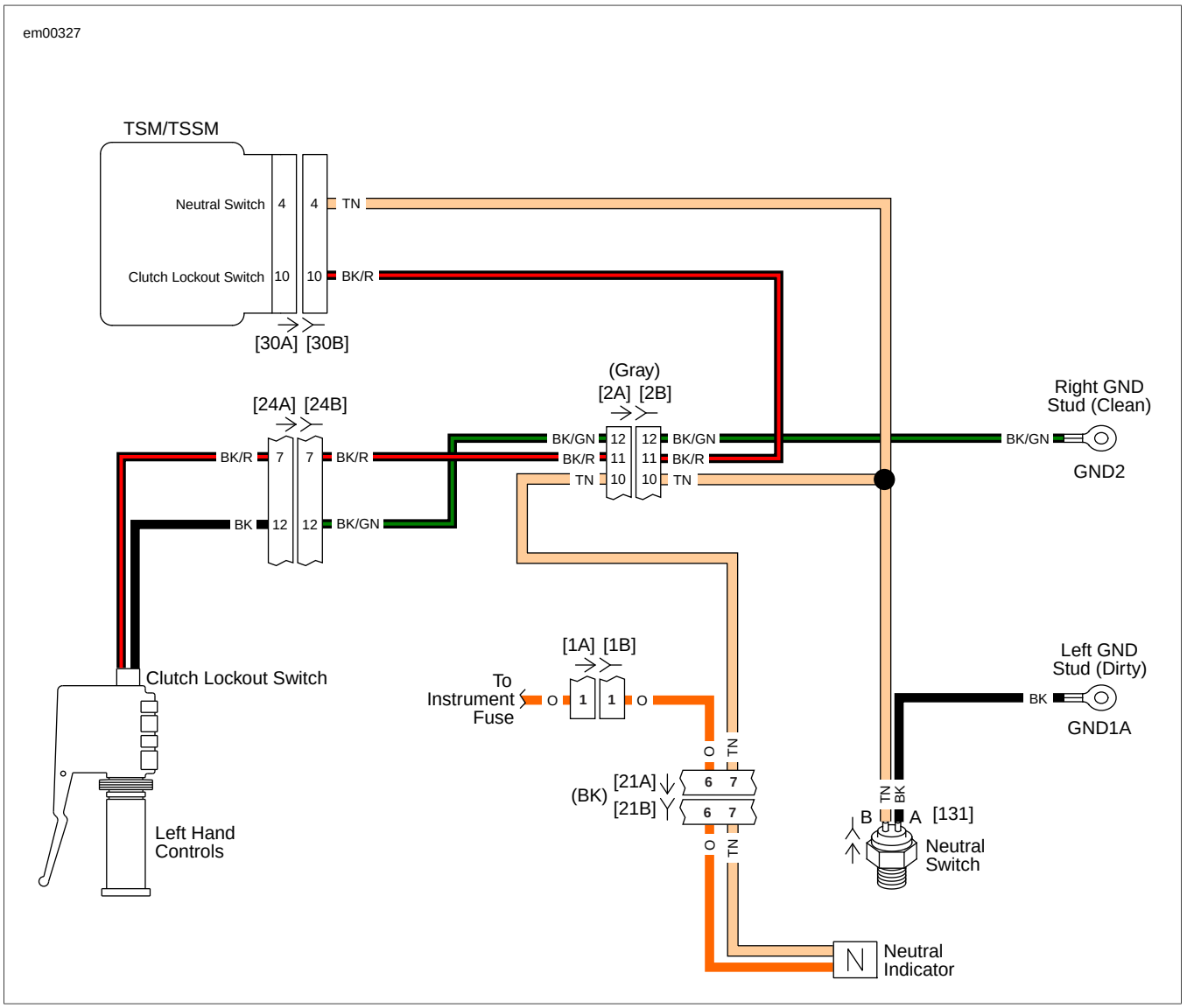


Figure E-25. Clutch and Neutral Interlock Circuits (FLHX, FLHT/C/U, FLTR)

Table E-22. Wire Harness Connectors

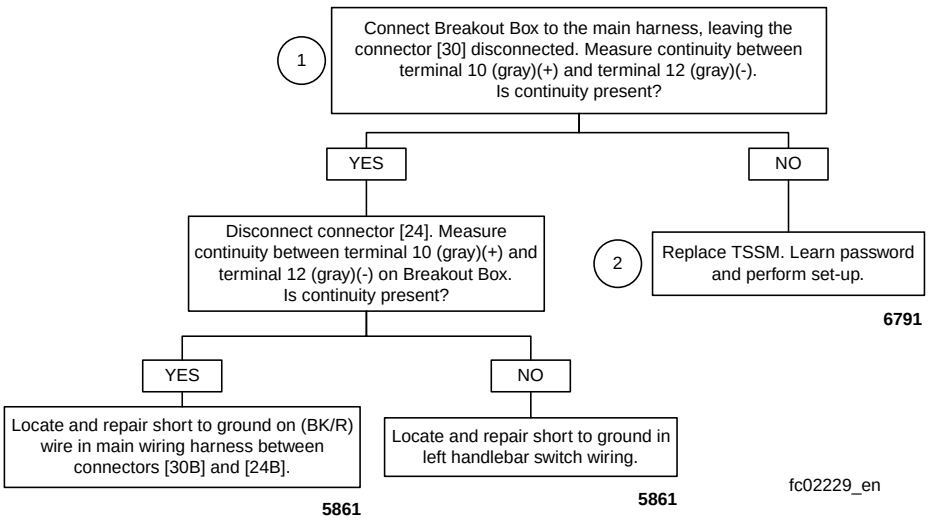
NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHX/T/C/U, FLTR	16-place Molex (black)	Inner fairing - right side below radio
[2]	Main to interconnect harness	FLHX/T/C/U, FLTR	12-place Molex (gray)	Inner fairing - left radio support bracket
[20]	Console harness	FLHR/C	16-place Molex	Under seat
[21]	Indicator lamps	FLHR/C	8-place Delphi	Under console
		FLHX/T/C/U, FLTR	8-place Delphi	Inner fairing - above radio
[24]	Left handlebar switches	FLHR/C	8-place Molex (gray)	Inside headlamp nacelle - fork stem nut lock plate
		FLHX/T/C/U, FLTR	16-place Molex (gray)	Inner fairing - left fairing support brace
[30]	TSM/TSSM	All	12-place Deutsch	Under right side cover

Table E-22. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[131]	Neutral switch	All	Post terminals	Top of transmission (right side)
[GND1] [GND1A] [GND2]	Harness grounds	All	Ring terminals	Under seat

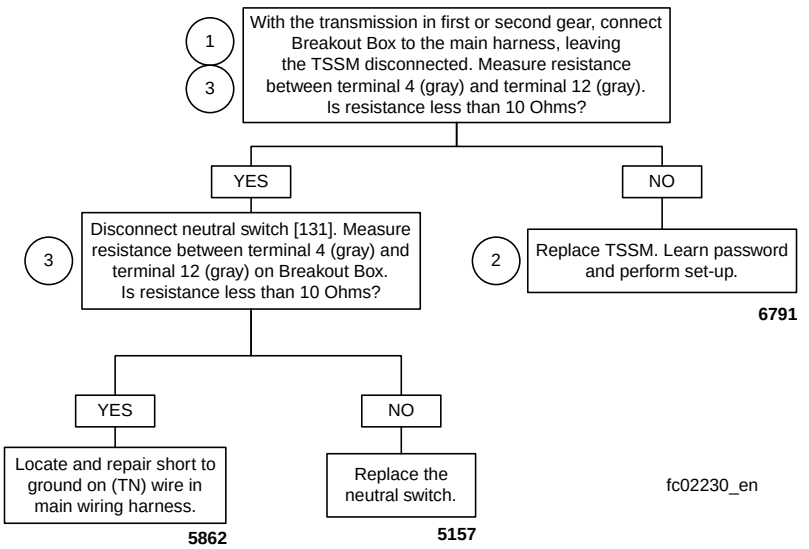
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1154



DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC B1155



DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC U1016 E.20

GENERAL

Loss of ECM Serial Data

See Figure E-26. The DLC provides a means for the ECM, ABS, radio, tachometer, TSM/TSSM, and speedometer to communicate their current status. When all operating parameters on the serial data bus are within specifications, a state of health message is sent between the components. A DTC U1016 indicates that the ECM is not capable of sending this state of health message. A DTC U1016 also indicates that there was communication on the data bus since power up, but was lost or interrupted during that key cycle.

Table E-23. Code Description

DTC	DESCRIPTION
U1016l	Loss of all ECM serial data

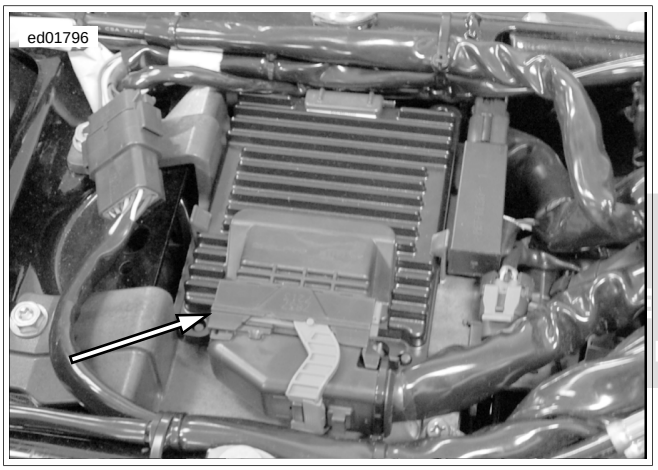


Figure E-26. Electronic Control Module (ECM)

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flowchart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/TSSM connector [30A] and wire harness connector [30B]. See E.11 BREAKOUT BOX: TSM/TSSM.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

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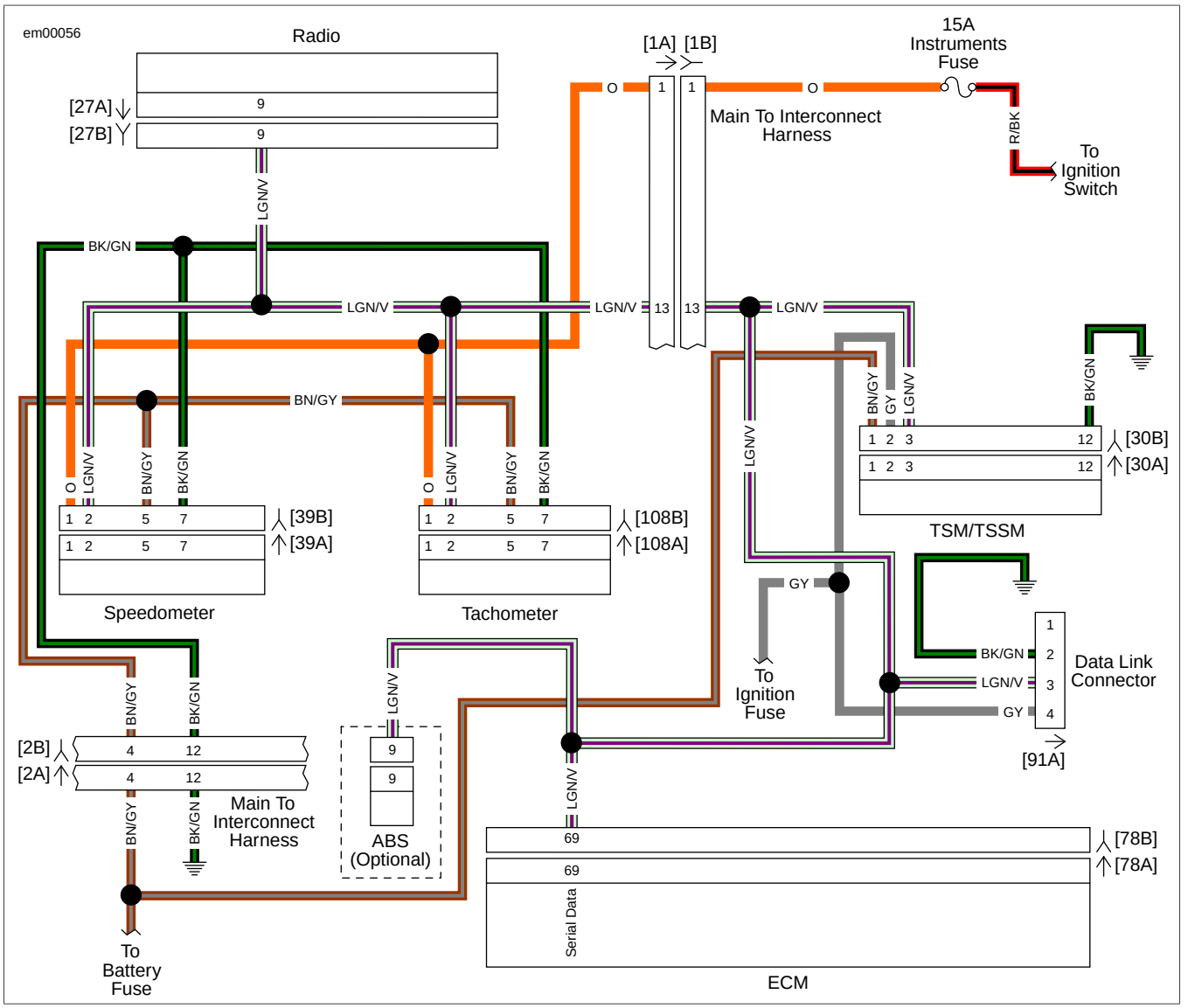


Figure E-27. Serial Data Circuit: FLHX, FLHT/C/U, FLTR

Table E-24. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to interconnect harness	FLHX/T/C	16-place Molex (Black)	Inner fairing - right radio support bracket
		FLTR	16-place Molex (Black)	Inner fairing - right side below radio
[2]	Main to interconnect harness	ALL	12-place Molex (Gray)	Inner fairing - left radio support bracket
[27]	Radio	All	23-place Amp	Inner fairing - back of radio (right side)
[30]	TSM/TSSM	All	12-place Deutsch	Under right side cover
[39]	Speedometer	FLHX/T/C	12-place Packard	Inner fairing (back of speedometer)
		FLTR	12-place Packard	Instrument nacelle (back of speedometer)
[78]	ECM	All	73-place Packard	Under seat
[91]	DLC	All	4-place Deutsch	Under left side cover

Table E-24. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[108]	Tachometer (If equipped)	FLHX/T/C	12-place Packard	Inner fairing (back of tachometer)
		FLTR	12-place Packard	Instrument nacelle (back of tachometer)
[166]	ABS (if equipped)	All	20-place Molex	Under right side cover

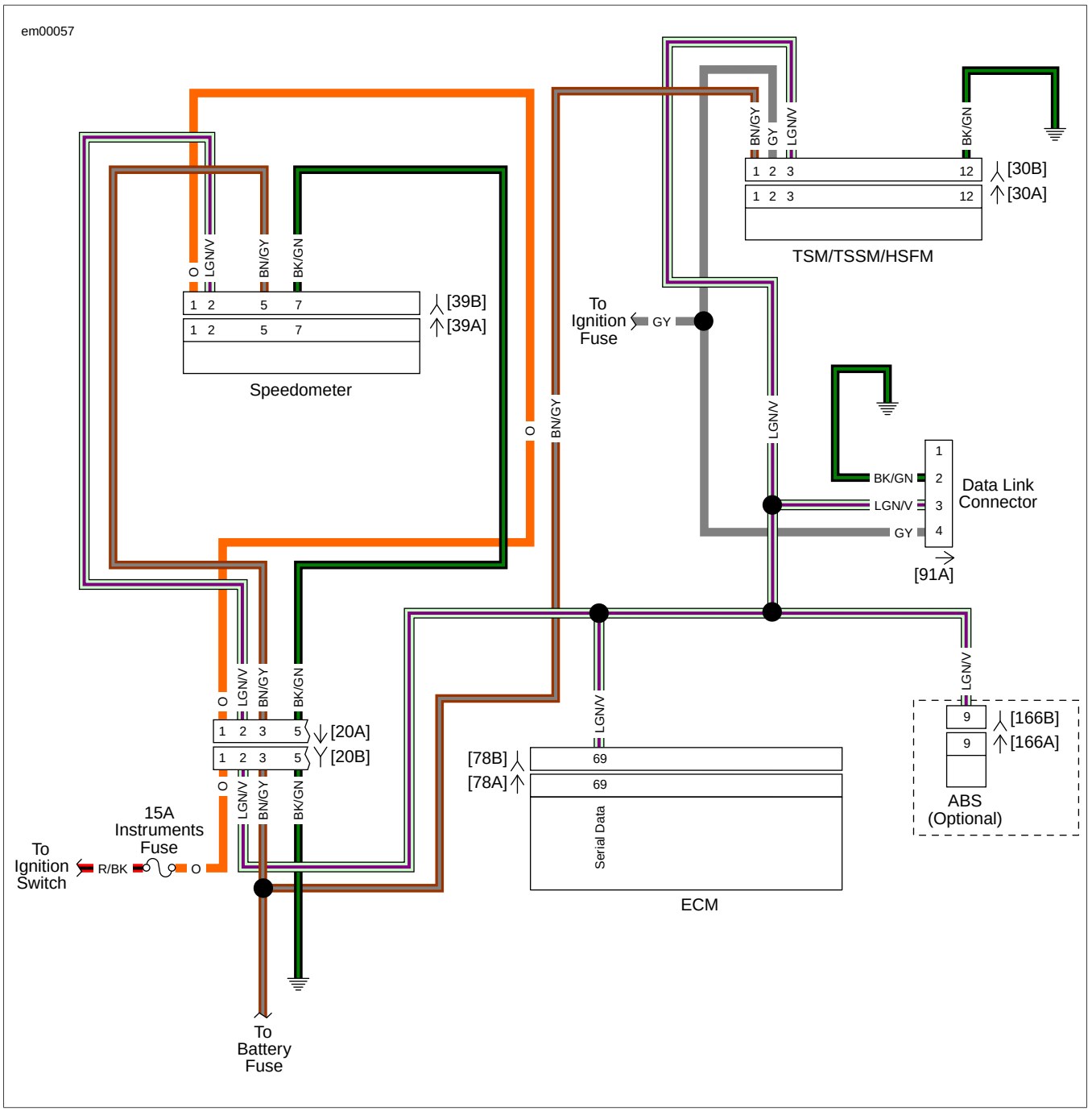


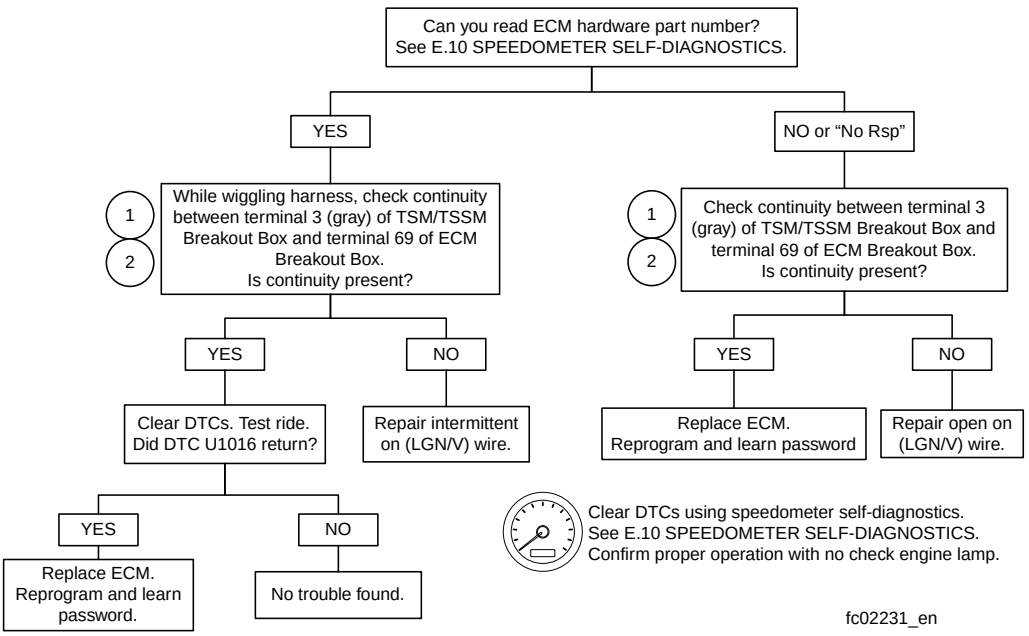
Figure E-28. Serial Data Circuit: FLHR/C

Table E-25. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[30]	TSM/TSSM	12-place Deutsch	Under right side cover
[39]	Speedometer	12-place Packard	Back of speedometer (back of console)
[78]	ECM	73-place Packard	Under seat
[91]	DLC	4-place Deutsch	Under left side cover
[166]	ABS	20-place Molex	Under right side cover

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC U1016



DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DTC U1300, U1301 OR BUS ER E.21

GENERAL

Serial Data Low or Serial Data Open/High

The typical serial data voltage range is 0 (inactive)-7 Volts (active). Due to the short pulse, voltage is much lower on a DVOM. In analog mode, a DVOM reading serial data shows continuous voltage when active, typically 0.6-0.8 Volt. The range for acceptable operations is 0-7.0 Volts.

Table E-26. Code Description

DTC	DESCRIPTION
U1300	Serial data low
U1301	Serial data bus open/high

DIAGNOSTICS

Diagnostic Tips

- If serial data is shorted, these DTCs automatically cause the check engine lamp to illuminate. The odometer reads BUS Er in this condition.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.

Diagnostic Notes

If a U1300, U1301 or BUS Er is present, perform diagnostic procedures listed in 4.11 STARTS, THEN STALLS.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TSM/TSSM: PASSWORD LEARN E.22

GENERAL

If the ECM or TSM/TSSM is faulty, follow the instructions in the service manual for ECM or TSM/TSSM replacement. Then, to determine if password learn is necessary, refer to Table E-27.

Table E-27. Password Learn

DEVICE REPLACED	IS PASSWORD LEARN NECESSARY?
ECM	Yes
TSM	No *
TSSM	Yes
* If a TSM has been replaced by a TSSM, or a TSSM has been replaced by a TSM, password learn is necessary.	

PASSWORD LEARNING

To perform password learning procedure, refer to Table E-27. When finished, continue with all instructions under E.3 TSM/TSSM VEHICLE DELIVERY.

Always perform all appropriate instructions under E.3 TSM/TSSM VEHICLE DELIVERY after TSM/TSSM replacement or removal.

NOTE

Do not forget to enter a PIN for TSSM vehicles. If a code is not assigned and the key fob is lost or damaged while the vehicle is armed, the TSSM must be replaced.

Table E-28. Setting TSM/TSSM and ECM Password

NO.	ACTION	CONFIRMATION	NOTES
	Ignition must be turned off for at least 15 seconds.	With ignition turned off, check engine lamp and security lamp are off.	
1	Install new TSM/TSSM or ECM. Perform all steps under E.3 TSM/TSSM VEHICLE DELIVERY.		
2	Set engine stop switch to RUN.		
3	Turn ignition switch on.	Verify check engine lamp and security lamp illuminate and then turn off.	TSM/TSSM enables starter relay.
4	Attempt normal start one time.	Engine starts and stalls. Check engine lamp illuminates and stays on.	Password has not been learned. ECM sets DTC P1009.
5	Wait ten seconds. Security lamp illuminates and stays on.	Security lamp illuminates.	ECM enters Password Learning mode for ten minutes. Do not cycle ignition switch or interrupt vehicle power or Password Learn will be unsuccessful.
6	Wait until security lamp turns off.		This takes 10 minutes.
7	Quickly (within 1 second) turn ignition switch OFF-IGNITION.		ECM must not be allowed to shutdown.
8	Wait until security lamp turns off.		This takes 10 minutes.
9	Quickly (within 1 second) turn ignition switch OFF-IGNITION.		ECM must not be allowed to shutdown.
10	Wait until security lamp turns off.		This takes 10 minutes.
11	Quickly (within 1 second) turn ignition switch OFF-IGNITION.		ECM must not be allowed to shutdown.
12	Turn ignition switch off. Wait 15 seconds before turning ignition switch on. Turn ignition switch on and start engine to confirm successful Password Learn procedure. Clear DTCs.		
13	Perform all steps under E.3 TSM/TSSM VEHICLE DELIVERY.		

TSSM MAINTENANCE E.23

GENERAL

The TSSM system uses batteries in the key fob and siren. These are the only parts requiring periodic maintenance.

KEY FOB

Schedule

Replace the key fob battery every two years.

Battery Replacement

1. See Figure E-30. Open the key fob case.
 a. Place a thin blade between the two halves of the case.
 b. Slowly twist the blade.
2. Replace battery (1).
 a. Remove the original battery.
 b. Install a **new** battery with the positive (+) side down. Use a Panasonic® 2032 or equivalent.
3. Align case and circuit board (3) as shown. Snap case halves together.
4. While standing next to the motorcycle, press and hold the key fob button for 10-15 seconds until the security system responds with two turn signal flashes/siren chirps.

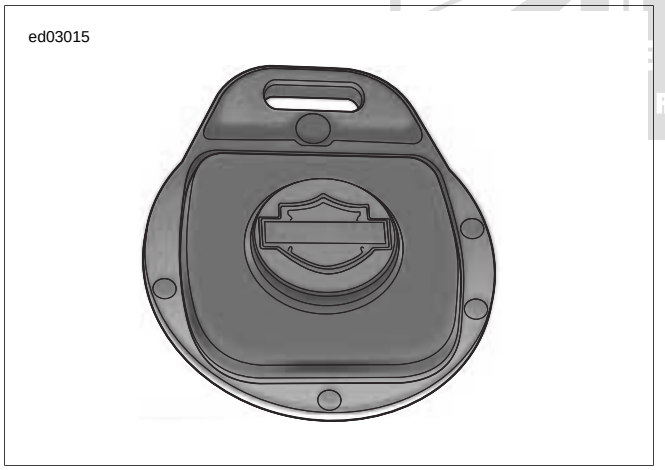
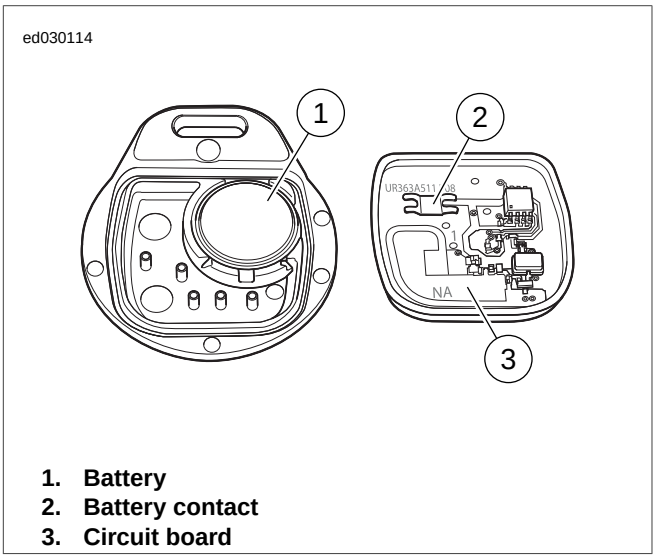


Figure E-29. Key Fob Assembly: TSSM



1. **Battery**
2. **Battery contact**
3. **Circuit board**

Figure E-30. Open Key Fob: TSSM

SIREN (IF INSTALLED)

Schedule

The siren's internal 9 Volt battery is rechargeable and does not need to be replaced on a regular basis. Battery life under normal conditions is approximately three to six years.

NOTES

- *See Figure E-31 and Figure E-32. Early style siren works with both TSSM and HFSM. Late style siren only works with HFSM.*
- *The internal siren battery may not charge if the motorcycle's battery is less than 12.5 Volts.*

Battery Replacement: Early Style Siren

1. Disarm system and remove siren.
2. See Figure E-31. Remove battery cover.
 a. Place the siren module on a flat and sturdy table with the potted section (area with epoxy covering circuit board) facing up and towards you.
 b. Position a knife blade at a 45 degree angle to the long side of the siren case. Insert the knife blade between the siren case and battery cover at one of the two accessible corners of the battery cover. Keep the blade slightly higher towards the battery cover as this helps keep the blade away from the battery seal.
 c. Slowly twist the blade towards the battery cover and the cover will pop off.

NOTES

- *For protection against corrosion, battery terminals and battery clip are covered with a special grease. Do not wipe away this substance. Apply all available existing grease to terminals on new battery.*
- *Use only a 9 Volt nickel metal hydride battery in the siren.*

3. Replace battery by removing old battery from polarized battery clip. Install a **new** 9 Volt nickel metal hydride battery.
4. Reinstall battery cover.
 a. Carefully replace the rubber seal.
 b. Align battery cover with case placing round corners on cover away from connector [142A]. Snap cover into place.
5. Install siren and check operation. If siren is working properly, it responds with two chirps after receiving the arm command.

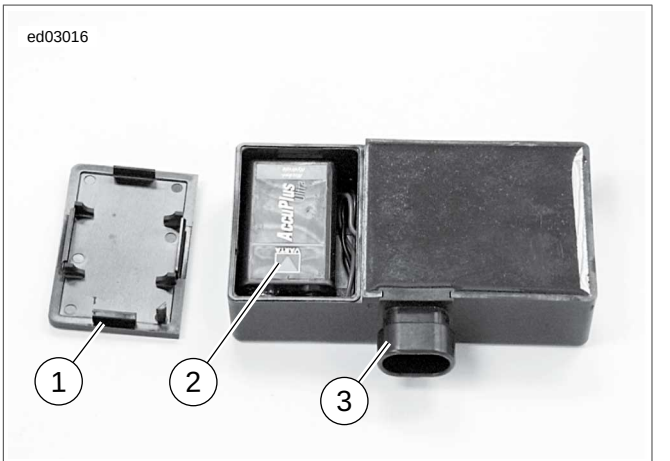
Battery Replacement: Late Style Siren

1. Disarm system and remove siren.
2. See Figure E-32. With a small screwdriver or pick, push the catches (1) in through the two slots (2) in the end of the siren to release the battery cover (3).

NOTES

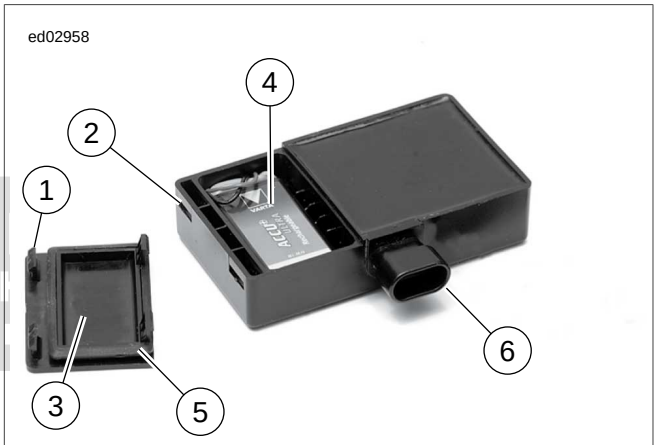
- *For protection against corrosion, battery terminals and battery clip are covered with a special grease. Do not wipe away this substance. Apply all available existing grease to terminals on new battery.*
- *Use only a 9 Volt nickel metal hydride battery in the siren.*

3. Replace battery (4) by removing old battery from polarized battery clip.
4. Recharge and re-install or install a **new** 9 Volt nickel metal hydride battery.
5. Reinstall battery cover (3).
 a. Carefully replace the rubber seal (5) on the cover.
 b. Align battery cover with case placing round corners on cover away from connector [142A] (6).
 c. Snap cover into place.
6. Install siren and check operation. If siren is working properly, it responds with two chirps after receiving the arm command.



1. **Cover**
2. **Battery**
3. **Connector [142A]**

Figure E-31. Battery Compartment (Early Style Siren)



1. **Catch**
2. **Slot**
3. **Cover**
4. **9 Volt battery**
5. **Rubber seal**
6. **Connector [142A]**

Figure E-32. Siren Battery Compartment (Late Style Siren)

NOTES

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-23738	VACUUM PUMP	4.16 DTC P0107, P0108, P0112, P0113, Diagnostics
HD-25070	ROBINAIR HEAT GUN	A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-26792	SPARK TESTER	4.9 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
HD-26792	SPARK TESTER	4.14 MISFIRE AT IDLE OR UNDER LOAD, Diagnostics
HD-34730-2C	FUEL INJECTOR TEST LAMP	4.9 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
HD-34730-2C	FUEL INJECTOR TEST LAMP	4.20 DTC P0261, P0262, P0263, P0264, Diagnostics
HD-34730-2C	FUEL INJECTOR TEST LAMP	4.22 DTC P0444, P0445, Diagnostics
HD-34730-2C	FUEL INJECTOR TEST LAMP	4.22 DTC P0444, P0445, Diagnostics
HD-34730-2C	FUEL INJECTOR TEST LAMP	4.32 DTC P1351, P1352, P1354, P1355, Diagnostics
HD-35500	MULTI-METER	2.6 FUEL GAUGE, Fuel Gauge and Sender Test
HD-38125-6	PACKARD TERMINAL CRIMP TOOL	A.14 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.6 DEUTSCH MINI-TERMINAL CRIMPS, Deutsch Mini Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.14 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.14 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-39448	DUMMY LOAD	5.5 ADVANCED AUDIO SYSTEM SYMPTOMS, Diagnostics
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL	A.5 DEUTSCH STANDARD TERMINALS, Deutsch Standard Terminal Crimps
HD-39969	ULTRA TORCH UT-100	A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-39978	DVOM	4.8 WIGGLE TEST, Procedure
HD-41183	HEAT SHIELD ATTACHMENT	A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41404-B	HARNESS CONNECTOR TEST KIT	1.2 STARTING SYSTEM DIAGNOSIS, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	1.7 CHARGING SYSTEM, Testing
HD-41404-B	HARNESS CONNECTOR TEST KIT	2.4 SPEEDOMETER/TACHOMETER, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	2.7 OIL, AIR AND VOLTMETER GAUGES, Oil Pressure Gauge and Indicator Light
HD-41404-B	HARNESS CONNECTOR TEST KIT	2.9 DTC B1004, B1005, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	3.16 DTC B1131, B1132 (HFSM ONLY), Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	3.20 DTC B1141 (HFSM ONLY), Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	3.22 DTC B1151, B1152, B1153, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.9 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.9 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.10 NO ECM POWER, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.12 FUEL SYSTEM ELECTRICAL TEST, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.14 MISFIRE AT IDLE OR UNDER LOAD, Diagnostics

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.15 COMBUSTION ABSENT/INTERMITTENT, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.16 DTC P0107, P0108, P0112, P0113, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.16 DTC P0107, P0108, P0112, P0113, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.17 DTC P0117, P0118, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.18 DTC P0120, P0122, P0123, P0220, P0222, P0223, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.20 DTC P0261, P0262, P0263, P0264, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.21 DTC P0373, P0374, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.22 DTC P0444, P0445, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.23 DTC P0501, P0502, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.27 DTC P0577, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.29 DTC P0641, P0651, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.32 DTC P1351, P1352, P1354, P1355, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.32 DTC P1351, P1352, P1354, P1355, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.33 DTC P1475, P1477, P1478, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.34 DTC P1501, P1502, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.38 DTC P2100, P2101, P2102, P2103, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.42 DTC P2122, P2123, P2127, P2128, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.43 DTC P2135, P2138, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	5.2 DTC B2006-B2015, RADIO SWITCH DIAGNOSTICS, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	5.4 SERIAL DATA BUS DIAGNOSTICS, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	5.5 ADVANCED AUDIO SYSTEM SYMPTOMS, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	6.12 DTC C1032, C1034, DTC C1032, C1034: Wheel Speed Sensor Circuit Open Or Shorted (Front or Rear)
HD-41404-B	HARNESS CONNECTOR TEST KIT	6.15 DTC C1094, DTC C1094: Front Brake Switch Always On
HD-41404-B	HARNESS CONNECTOR TEST KIT	6.20 DTC C1212, DTC C1212: Front or Rear Brake Not Applied with Decel
HD-41404-B	HARNESS CONNECTOR TEST KIT	E.13 TSM/TSSM TURN SIGNAL ERRORS: B1121, B1122, B1141, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	E.15 DTC B1131, B1132, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	E.18 DTC B1151, B1152, B1153, Diagnostics
HD-41475	DEUTSCH CONNECTOR SERVICE KIT	A.4 DEUSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41475-100	FLAT BLADE L-HOOK	A.4 DEUSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41609	AMP MULTILOCK CRIMPER	A.1 AMP MULTILOCK CONNECTORS, AMP Multilock Connector Repair
HD-41609	AMP MULTILOCK CRIMPER	A.1 AMP MULTILOCK CONNECTORS, AMP Multilock Connector Repair
HD-42682	BREAKOUT BOX	1.2 STARTING SYSTEM DIAGNOSIS, Diagnostics
HD-42682	BREAKOUT BOX	2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER, General

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HD-42682	BREAKOUT BOX	2.4 SPEEDOMETER/TACHOMETER, Diagnostics
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HD-42682	BREAKOUT BOX	2.5 BREAKOUT BOX: SPEEDOMETER/TACHOMETER, Installation
HD-42682	BREAKOUT BOX	2.5 BREAKOUT BOX: SPEEDOMETER/TACHOMETER, Removal
HD-42682	BREAKOUT BOX	2.9 DTC B1004, B1005, Diagnostics
HD-42682	BREAKOUT BOX	2.11 DTC B1008, Diagnostics
HD-42682	BREAKOUT BOX	2.12 DTC U1016, Diagnostics
HD-42682	BREAKOUT BOX	2.13 DTC U1064, U1255, Diagnostics
HD-42682	BREAKOUT BOX	2.13 DTC U1064, U1255, Diagnostics
HD-42682	BREAKOUT BOX	2.13 DTC U1064, U1255, Diagnostics
HD-42682	BREAKOUT BOX	3.3 H-DSSS ACTUATION, Power Disruption and Configuring
HD-42682	BREAKOUT BOX	3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM, General
HD-42682	BREAKOUT BOX	3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM, Initial Diagnostics
HD-42682	BREAKOUT BOX	3.12 BREAKOUT BOX: TSM/HFSM, General
HD-42682	BREAKOUT BOX	3.16 DTC B1131, B1132 (HFSM ONLY), Diagnostics
HD-42682	BREAKOUT BOX	3.17 DTC B1134, Diagnostics
HD-42682	BREAKOUT BOX	3.22 DTC B1151, B1152, B1153, Diagnostics
HD-42682	BREAKOUT BOX	3.23 DTC B1154, B1155, Diagnostics
HD-42682	BREAKOUT BOX	4.45 DTC U1064, Diagnostics
HD-42682	BREAKOUT BOX	E.3 TSM/TSSM VEHICLE DELIVERY, Power Disruption and Configuring
HD-42682	BREAKOUT BOX	E.9 INITIAL DIAGNOSTIC CHECK: TSM/TSSM, General
HD-42682	BREAKOUT BOX	E.9 INITIAL DIAGNOSTIC CHECK: TSM/TSSM, Initial Diagnostics
HD-42682	BREAKOUT BOX	E.11 BREAKOUT BOX: TSM/TSSM, General
HD-42682	BREAKOUT BOX	E.15 DTC B1131, B1132, Diagnostics
HD-42682	BREAKOUT BOX	E.16 DTC B1134, Diagnostics
HD-42682	BREAKOUT BOX	E.18 DTC B1151, B1152, B1153, Diagnostics
HD-42682	BREAKOUT BOX	E.19 DTC B1154, B1155, Diagnostic Notes
HD-42879	ELECTRICAL CRIMPER TOOL	A.7 DEUTSCH SOLID BARREL TERMINALS, Deutsch Solid Barrel Terminal Crimps
HD-43876	BREAKOUT BOX	2.12 DTC U1016, Diagnostics
HD-43876	BREAKOUT BOX	5.4 SERIAL DATA BUS DIAGNOSTICS, Diagnostics
HD-43876	BREAKOUT BOX	E.20 DTC U1016, Diagnostics
HD-44687	IGNITION COIL CIRCUIT TEST ADAPTER	4.9 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
HD-44687	IGNITION COIL CIRCUIT TEST ADAPTER	4.32 DTC P1351, P1352, P1354, P1355, Diagnostics
HD-45928	PACKARD MICRO-64 TERMINAL REMOVER	A.17 PACKARD MICRO-64 CONNECTORS, Packard Micro-64 Connector Repair

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HD-46601	INSTRUMENT HARNESS ADAPTERS	2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER, Initial Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.4 SPEEDOMETER/TACHOMETER, Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.5 BREAKOUT BOX: SPEEDOMETER/TACHOMETER, General
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.5 BREAKOUT BOX: SPEEDOMETER/TACHOMETER, Installation
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.5 BREAKOUT BOX: SPEEDOMETER/TACHOMETER, Removal
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.9 DTC B1004, B1005, Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.11 DTC B1008, Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.13 DTC U1064, U1255, Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.13 DTC U1064, U1255, Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM, Initial Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	4.5 INITIAL DIAGNOSTIC CHECK: EFI, Initial Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	4.46 DTC U1097, Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	6.3 BREAKOUT BOX: ABS, Installation
HD-46601	INSTRUMENT HARNESS ADAPTERS	6.3 BREAKOUT BOX: ABS, Installation
HD-46601	INSTRUMENT HARNESS ADAPTERS	6.3 BREAKOUT BOX: ABS, Removal
HD-46601	INSTRUMENT HARNESS ADAPTERS	E.9 INITIAL DIAGNOSTIC CHECK: TSM/TSSM, Initial Diagnostics
HD-47918	RADIO BREAKOUT BOX	5.2 DTC B2006-B2015, RADIO SWITCH DIAGNOSTICS, Diagnostics
HD-47918	RADIO BREAKOUT BOX	5.3 DTC B2016-B2027, RADIO SPEAKER DIAGNOSTICS, Diagnostics
HD-47918	RADIO BREAKOUT BOX	5.5 ADVANCED AUDIO SYSTEM SYMPTOMS, Diagnostics
HD-48037	SWR METER ADAPTERS	5.5 ADVANCED AUDIO SYSTEM SYMPTOMS, Diagnostics
HD-48037	SWR METER ADAPTERS	5.5 ADVANCED AUDIO SYSTEM SYMPTOMS, Diagnostics
HD-48053	ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER	1.7 CHARGING SYSTEM, Troubleshooting
HD-48053	ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER	1.7 CHARGING SYSTEM, Testing
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER	A.15 MOLEX CONNECTORS, Molex Connector Repair
HD-48637	BREAKOUT BOX	3.24 DTC U1016, Diagnostics
HD-48637	BREAKOUT BOX	4.5 INITIAL DIAGNOSTIC CHECK: EFI, General
HD-48637	BREAKOUT BOX	4.5 INITIAL DIAGNOSTIC CHECK: EFI, Initial Diagnostics
HD-48637	BREAKOUT BOX	4.7 BREAKOUT BOX: EFI, General
HD-48637	BREAKOUT BOX	4.8 WIGGLE TEST, Procedure

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PART NUMBER	TOOL NAME	NOTES
HD-48637	BREAKOUT BOX	4.10 NO ECM POWER, Diagnostics
HD-48637	BREAKOUT BOX	4.12 FUEL SYSTEM ELECTRICAL TEST, Diagnostics
HD-48637	BREAKOUT BOX	4.13 SYSTEM RELAY FAULT, Diagnostics
HD-48637	BREAKOUT BOX	4.15 COMBUSTION ABSENT/INTERMITTENT, Diagnostics
HD-48637	BREAKOUT BOX	4.16 DTC P0107, P0108, P0112, P0113, Diagnostics
HD-48637	BREAKOUT BOX	4.16 DTC P0107, P0108, P0112, P0113, Diagnostics
HD-48637	BREAKOUT BOX	4.17 DTC P0117, P0118, Diagnostics
HD-48637	BREAKOUT BOX	4.18 DTC P0120, P0122, P0123, P0220, P0222, P0223, Diagnostics
HD-48637	BREAKOUT BOX	4.19 DTC P0131, P0132, P0134, P0151, P0152, P0154, Diagnostics
HD-48637	BREAKOUT BOX	4.20 DTC P0261, P0262, P0263, P0264, Diagnostics
HD-48637	BREAKOUT BOX	4.22 DTC P0444, P0445, Diagnostics
HD-48637	BREAKOUT BOX	4.23 DTC P0501, P0502, Diagnostics
HD-48637	BREAKOUT BOX	4.29 DTC P0641, P0651, Diagnostics
HD-48637	BREAKOUT BOX	4.30 DTC P1009, P1010, Diagnostics
HD-48637	BREAKOUT BOX	4.32 DTC P1351, P1352, P1354, P1355, Diagnostics
HD-48637	BREAKOUT BOX	4.33 DTC P1475, P1477, P1478, Diagnostics
HD-48637	BREAKOUT BOX	4.34 DTC P1501, P1502, Diagnostics
HD-48637	BREAKOUT BOX	4.38 DTC P2100, P2101, P2102, P2103, Diagnostics
HD-48637	BREAKOUT BOX	4.40 DTC P2107, Diagnostics
HD-48637	BREAKOUT BOX	4.43 DTC P2135, P2138, Diagnostics
HD-48637	BREAKOUT BOX	4.45 DTC U1064, Diagnostics
HD-48637	BREAKOUT BOX	4.46 DTC U1097, Diagnostics
HD48642	BREAKOUT BOX	6.3 BREAKOUT BOX: ABS, Installation
HD-48642	BREAKOUT BOX	6.3 BREAKOUT BOX: ABS, General
HD-48642	BREAKOUT BOX	6.3 BREAKOUT BOX: ABS, Removal
HD-48642	BREAKOUT BOX	6.4 INITIAL DIAGNOSTIC CHECK: ABS, General
HD-48642	BREAKOUT BOX	6.8 DTC C1017, DTC C1017: Pump Motor Power Circuit Open Fault
HD-48642	BREAKOUT BOX	6.9 DTC C1018, DTC C1018: Pump Motor Ground High Resistance Fault
HD-48642	BREAKOUT BOX	6.11 DTC C1025, C1027, C1206, C1208, DTC C1025, C1027, C1206, C1208: Wheel Speed Signal Intermittent or Frequency Out Of Range
HD-48642	BREAKOUT BOX	6.12 DTC C1032, C1034, DTC C1032, C1034: Wheel Speed Sensor Circuit Open Or Shorted (Front or Rear)
HD-48650	DIGITAL TECHNICIAN II	2.1 CHECKING FOR DIAGNOSTIC TROUBLE CODES, Code Types
HD-48650	DIGITAL TECHNICIAN II	2.4 SPEEDOMETER/TACHOMETER, Odometer Theory of Operation
HD-48650	DIGITAL TECHNICIAN II	3.2 HARLEY-DAVIDSON SMART SECURITY SYSTEM, HFSM Features
HD-48650	DIGITAL TECHNICIAN II	3.7 SERVICE/EMERGENCY FUNCTIONS, Service Mode

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HD-48650	DIGITAL TECHNICIAN II	3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM, General
HD-48650	DIGITAL TECHNICIAN II	3.22 DTC B1151, B1152, B1153, Diagnostics
HD-48650	DIGITAL TECHNICIAN II	3.26 TSM/HFSM: PASSWORD LEARN, Password Learning
HD-48650	DIGITAL TECHNICIAN II	4.5 INITIAL DIAGNOSTIC CHECK: EFI, General
HD-48650	DIGITAL TECHNICIAN II	4.19 DTC P0131, P0132, P0134, P0151, P0152, P0154, Diagnostics
HD-48650	DIGITAL TECHNICIAN II	5.1 RADIO DIAGNOSTICS, Onboard Diagnostics
HD-48650	DIGITAL TECHNICIAN II	6.1 ANTI-LOCK BRAKE SYSTEM (ABS) GENERAL INFORMATION, ABS Description
HD-48650	DIGITAL TECHNICIAN II	6.6 DTC C0562, DTC C0562: Device Voltage Low
HD-48650	DIGITAL TECHNICIAN II	6.9 DTC C1018, DTC C1018: Pump Motor Ground High Resistance Fault
HD-48650	DIGITAL TECHNICIAN II	6.10 DTC C1021, C1023, DTC C1021, C1023: Wheel Speed Sensor Equals Zero (Front or Rear)
HD-48650	DIGITAL TECHNICIAN II	6.12 DTC C1032, C1034, DTC C1032, C1034: Wheel Speed Sensor Circuit Open Or Shorted (Front or Rear)
HD-48650	DIGITAL TECHNICIAN II	6.13 DTC C1042, DTC C1042: Pump Motor Open
HD-48650	DIGITAL TECHNICIAN II	6.16 DTC C1095, DTC C1095: Front Brake Switch Open
HD-48650	DIGITAL TECHNICIAN II	6.21 DTC C1214, DTC C1214: Rear Brake Switch Always On
HD-48650	DIGITAL TECHNICIAN II	E.8 DIAGNOSTIC TROUBLE CODES (DTC), Code Types
HD-48650	DIGITAL TECHNICIAN II	E.9 INITIAL DIAGNOSTIC CHECK: TSM/TSSM, General
HD-48650	DIGITAL TECHNICIAN II	E.18 DTC B1151, B1152, B1153, Diagnostics
SNAP-ON TT600-3	SNAP-ON PICK	A.12 630 METRI-PACK CONNECTORS, 630 Metri-Pack Connector Repair
TT600-3	SNAP-ON PICK	A.1 AMP MULTILOCK CONNECTORS, AMP Multilock Connector Repair

FASTENER	TORQUE VALUE	NOTES
No torque values were found in this manual.		

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